DUKANE

Intelligent Assembly Solutions

iQ Series

ULTRASONIC GENERATOR/POWER SUPPLY

Pneumatic Systems

ES

AUTOMATED HAND PROBE PRESS

User's Manual

Dukane Part No. 403-584-00

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SECTION 1

Introduction

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General User Information

Read this Manual First

Before operating your ultrasonic system, read this User's Manual to become familiar with the equipment. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this equipment. The examples given are chosen for their simplicity to illustrate basic operation concepts.

This manual provides information to set up, operate, and interface this generator/power supply as an integral part of Dukane's ***iQ Series*** ES press system.

Particular models are listed in ***Section 11 - Specifications***.

Notes, Cautions and Warnings

Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a operator protection issue.

Drawings and Tables

The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use Arabic sequence numbers (e.g. –1, –2, –3) while the tables use Roman sequence numerals (e.g. –I, –II, –III). As an example, Figure 3–2 would be the second illustration in section three while Table 3–II would be the second table in section three.

NOTE

Note statements provide additional information or highlight procedures.

CAUTION

Caution statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING

Warning statements point out conditions or practices that could result in personal injury or loss of life.

Condition or Practice

Electrical Safety Issue

Operator Protection (hearing)

Press System Overview

An ***iQ Series*** Ultrasonic Press System ES consists of these components: the ***iQ*** generator, press (with thruster, switches, controls, cables, transducer, booster, horn, and fixture) and ***iQ Explorer II*** software. The software allows the operator to control the system either remotely or at the press location.

The ***iQ Series ES*** generator has rugged internal ultrasonic circuitry and ensures a continuous resonant frequency lock at the start of each weld.

The generator's compact size allows multiple units to be placed into an industrial equipment cabinet. This generator will operate at the same international line voltage input specifications as the other generators of this product family (unless the 120V option is installed). It also includes an RFI line filter that passes FCC, CE, UL, and CSA testing for global applications.

Key Generator Features

- The **Generator Interface** has a 5" LCD color display and soft keys to ease the intuitive menu navigation.
- **Digital Control** of all power supply functions, including digital frequency synthesis, and parameters allows for unique configurations and allows for future upgrades.
- **Process Parameters** such as frequency, amplitude and power are all updated at a 0.5 ms rate.
- **Pulse Width Modulation** incorporates patented circuitry giving the power supply the ability to efficiently change and maintain the output amplitude. This makes it possible to start large horns with reduced power. It also provides more power-efficient switch-mode generator operation and increased reliability.
- **Linear Ramp Up/Down** circuitry allows the acoustic stack to be brought to operating amplitude smoothly, minimizing start-up surges and undue stress to stack and generator. This circuitry also allows decreases to amplitude as the weld cycle ends. The stack is brought down from its maximum operating amplitude smoothly, reducing shock stress.
- **Digi-Trac Tuning** tracks the resonant frequency of the acoustic stack (horn, booster, and transducer) and adjusts the generator output frequency to match it. This is done for every weld cycle and eliminates the need to manually tune the generator.
- **Line Voltage Regulation** automatically maintains constant amplitude regardless of line voltage deviation. The available output power is maintained with any voltage input within the specified range. This provides consistent system performance regardless of line voltage fluctuations. It also eliminates the need for bulky, external constant–voltage transformers.
- **Load Regulation** provides constant ultrasound amplitude automatically regardless of power draw. The ultrasonic output amplitude level is held to within ±1% to provide weld process consistency and reduced weld cycle times.
- **Wide Line Voltage Operation** means that standard systems will operate worldwide within their standard AC voltage ranges.
- **Flow Through Cooling Tunnel** with a matched high–performance heatsink and thermostatically controlled fan reduces thermal gradients and increases component life.
- **AC Power Inrush** protection reduces electrical stress on the internal components by protecting them from AC power startup transient current surges.
- **Multiple Electronic Overload** protection circuits prevent instantaneous component failure in the event of extreme output overload conditions. The overload power limit is based on the actual true RMS power output level.
- **Process Limits** include: distance, time only, time and energy, and peak power. These programmable limits provide the means to adapt to a wide variety of welding applications.
- **Rear Panel Expansion Slot** is available to allow for custom configurations for OEM and cost effective solutions.
- **RS-232 Serial Configuration Port** is used for field software upgrades, troubleshooting and advanced hardware setup with optional PC-based configurator.
- **CE Certification** means that the system meets the required European standards to be sold and used in Europe (high line voltage models only).
- **ISO 9001 Certification** means that this system has been manufactured to high quality standards and assures you of manufacturing excellence.
- **TUV Certification** - TÜV Rheinland certifies Dukane products comply with applicable UL (Underwriters Laboratories) and CSA (Canadian Standards Association) requirements.

SECTION 2

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General Considerations

Please observe these **health and safety recommendations** for safe, efficient, and injury-free operation of your equipment.

Proper Installation - Operate system components only after they are properly installed.

No Unauthorized Modifications - Do not modify your system in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications could cause equipment damage and/or injury to the operator. In addition, unauthorized modifications will void equipment warranty.

Keep the Cover On - Do not remove any equipment cover unless directed to do so by Dukane Corporation. The generator produces hazardous electrical voltages which could cause injury.

Grounded Electrical Power - Operate this equipment only with a grounded electrical connection.

See ***Electrical Safety*** for grounding instructions, Page 9.

Comply with Regulations - You may be required to add accessories to bring the system into compliance with applicable regulations (OSHA in the USA) for machine guarding and noise exposure.

Use Eye Protection - Wear ANSI approved safety impact goggles.

Acoustic Stack Hazard - When an acoustic stack (transducer, booster, horn and tip) is energized by the ultrasound signal, it presents a potential hazard. Stay clear of an energized stack.

System E-STOP **(abort) Switch** - Install a system E-STOP (abort) switch at each operator station when ultrasonic plastic assembly equipment is used with automatic material handling equipment in an automated system.

Foot Switch - Do not use a foot switch. Using a foot switch in place of the optical touch finger switches (operate switches) violates OSHA regulations.

NOTE

These recommendations apply to the welding system. System in this manual refers to a complete group of components associated with the welding of parts, also known as an ultrasonic assembly system. A typical ***iQ Series*** System consists of the iQ generator, a press with thruster, switches, controls, cables, transducer, booster, horn, fixture, and ***iQ Explorer II*** software.

WARNING

Any fixture manufactured by a third party must comply with all OSHA and ANSI requirements. All fixtures must be guarded as necessary.

Dukane Corporation does not assume any responsibility or liability for fixtures manufactured by the customer or any third party manufacturer.

WARNING

Never operate the generator with the cover off. This is an unsafe practice and may cause injury.

CAUTION

At some time you may be asked to remove equipment covers by the Dukane Service Dept. personnel. Before doing so, disconnect the unit electrically from the incoming line AC power. If the unit is a press/thruster, lock the Air Lockout Valve, located on the rear panel, in its closed position.

Continued

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General Considerations

Pre-trigger Switch Adjustment - The pre-trigger switch option starts the horn vibrating before contacting the part to be welded. To ensure safe operation, adjust the pre-trigger so the ultrasound signal will not activate if the horn is more than ¼ in (7 mm) from the part to be welded.

System Electrical Cabling - Electrical power must be off when connecting or disconnecting electrical cables.

Do Not Wear Loose Clothing or Jewelry - They can become caught in moving parts.

Stay Alert - Watch what you are doing at all times. Use common sense. Do not operate the press when you are tired or distracted from the job at hand.

Do Not Operate the Equipment - Your judgement or reflexes could be impaired while taking prescription medications. If so, do not operate the equipment. Be familiar with warning labels and recommended activity restrictions that accompany your prescription medications. If you have any doubt, do not operate the equipment.

Plastics Health Notice

Certain plastic materials, when being processed, may emit fumes and/or gases that may be hazardous to the operator's health. Proper ventilation of the work station should be provided where such materials are processed. Inquiries should be made to the U.S. Department of Labor concerning OSHA regulations for a particular plastic prior to processing with Dukane ultrasonic equipment.

Electrical Safety

The ***iQ Series*** generator provides the operating power and power returns. Make sure the generator is grounded properly.

In addition to the safety considerations, proper grounding is essential for the effective suppression of RFI (Radio Frequency Interference). Every generator contains a RFI filter which blocks noise on the AC power line from entering the generator control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line.

If you experience problems with RFI from the press, run an additional grounding wire from the press base grounding stud to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. Use at least 14 AWG wire for the connection to the press base.

CAUTION

Parts being joined ultrasonically will at times vibrate at audible frequencies. Wear ear protectors to reduce annoying or uncomfortable sounds. In addition, ultrasound baffles, sound enclosures, or materials that absorb sound may be located to surround the system. Ultrasound pressure level could exceed 110dB. See Ultrasonic Pressure, Table 11-IV, Page 134.

WARNING

Keep head, hands, limbs and body at least six inches (152 mm) away from an operating press/thruster. A vibrating, descending horn can cause burns and/or crushing injuries.

CAUTION

When making cable connections to system equipment or disconnecting cables from system equipment, make sure electrical power to the system is turned off, and AC power cords are removed from their receptacles. After the cables have been securely connected and the connections and cable routing checked a final time, the power may be restored.

Continued

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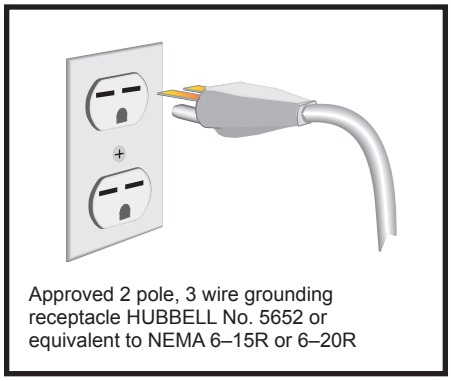
Electrical Safety

Domestic Power Grounding

For safety, the power cords used on this product have a three-wire, grounding-type power cord. Figure 2-1 illustrates the appropriate electrical outlet to use with the power cord that is included with systems shipped to North America.



Approved 2 pole, 3 wire grounding receptacle HUBBELL No. 5652 or equivalent to NEMA 6–15R or 6–20R

Figure 2–1 Example of 220/240 Volt, Grounded, 3-Prong Receptacle

International Power Grounding

The power cable normally provided for international use is compatible with the power outlet used in many Continental European countries (Refer to Figure 2–2.) However, if your application requires another type of power cord, check with your equipment supplier, and follow local regulations concerning proper wiring and grounding.

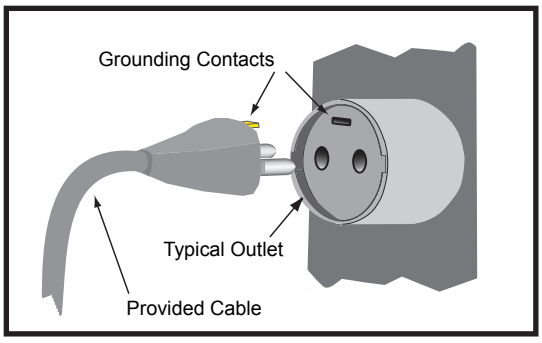


Figure 2–2 International 220/240V Grounding

CAUTION

If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply.

See Figures 2–1 and 2–2.

CAUTION

If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

100/120 Volt AC Systems (North America or Japan)

The power cord (including strain relief) supplied with the 100/120VAC systems is permanently attached to the rear of the generator. Units with this power cord are for use in North America or Japan.

240V Systems

High power generators with power ratings above 2400W also use permanently attached power cords.

Lifting the Equipment

How to Lift Safely

- Before lifting, take a moment to think about what you're about to do.
- Examine the object for sharp corners, slippery spots or other potential hazards. Know your limit and don't try to exceed it.
- Ask for help if needed, or if possible, divide the load to make it lighter.
- Know where you are going to set the item down, and make sure it and your path are free of obstructions. Then follow these steps:

    1. Stand close to the load with your feet spread apart about shoulder width, with one foot slightly in front of the other for balance.
    2. Squat down bending at the knees (not your waist). Tuck your chin while keeping your back as vertical as possible.
    3. Get a firm grasp of the object before beginning the lift. Begin slowly lifting with your LEGS by straightening them. Never twist your body during this step.
    4. Once the lift is complete, keep the object as close to the body as possible. As the load's center of gravity moves away from the body, there is a dramatic increase in stress to the lumbar region of the back.
    5. If you must turn while carrying the load, turn using your feet-not your torso. To place the object below the level of your waist, follow the same procedures in reverse order. Remember, keep your back as vertical as possible and bend at the knees.

NOTE

For equipment weights see Page 132, Table 11-I in ***Section 11, Specifications***.

CAUTION

Take care when lifting the equipment. We recommend using a mechanical lift device to assist.

SECTION 3

Installation

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Before Installation

As you plan for the installation of your generator, please consider these important subjects as listed below:

- When to use lockout / tagout devices
- Lifting the generator safely - See ***Section 2 - Health and Safety***, Page 10.

When to Use Lockout / Tagout Devices

Figure 3-1 Lockout Device In Open Position, Unlocked

The typical kind of LOTO device for this generator is a clam shell type device (with lockout capability). The LOTO device is placed over the plug end of the generator electrical cord. This effectively prevents access to the energy isolation point. See the example of one such device in the figure above.

The figure to the right shows the lockout device in the closed, locked position.

Figure 3-2 Bottom Lockout Device In Closed Position, Locked

WARNING

Electrical safety hazards exist inside the generator chassis. Before making any internal adjustments to the generator, apply a lockout/tagout (LOTO) device to the generator chassis.

Continued

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Lockout/Tagout

Procedure to use BEFORE making any internal adjustments to the generator:

1. Push the generator's AC power switch/breaker to the OFF position.
2. Unplug the generator's electrical cord from its source.
3. Authorized personnel apply a lockout/tagout (LOTO) device to the plug end of the generator's electrical cord. Using a typical clam shell type LOTO device:
   1) Open the clam shell.
   2) Place the electrical cord plug end inside the shell.
   3) Close the shell.
   4) Secure the shell with its lock, and lock it.
4. Wait a minimum of five minutes for the generator to discharge its electrical energy.
5. After taking these steps, make the necessary adjustments to the generator.

Assuming the generator is being put back into service. . .

Procedure to use AFTER making any internal adjustments to the generator:

1. Authorized personnel remove the lockout/tagout device from the plug end of the generator's electrical cord. Using a typical clam shell type LOTO device:
   1) Unlock the protective shell.
   2) Open the shell, exposing the electrical cord end.
   3) Remove the LOTO device, and set it aside.
2. Plug the generator's electrical cord into its AC power source.
3. Push the generator's AC power switch/breaker to the ON position.

Unpacking

Carefully open your shipping container, and make sure it contains the items shown on the shipping documents. Inspect all items, and report any damage immediately.

Placement

Generator placement and cable routing should permit easy access and not interfere with normal system operation.

Allow at least 5 inches [13 cm] of space on both ends of the generator chassis for air circulation. Allow space - between 3-6 inches, [8-15 cm] - at the rear of the chassis for cable clearance. (*The amount of space depends on the chassis type and what rear panel connections there are.*)

See ***Section 11 - Specifications,*** for generator drawings.

CAUTION

Allow 5 inches for air ventilation at the cooling air inlet and at the exhaust air outlet. The fan draws in fresh air to cool the internal components, reduce thermal gradients and increase component life.

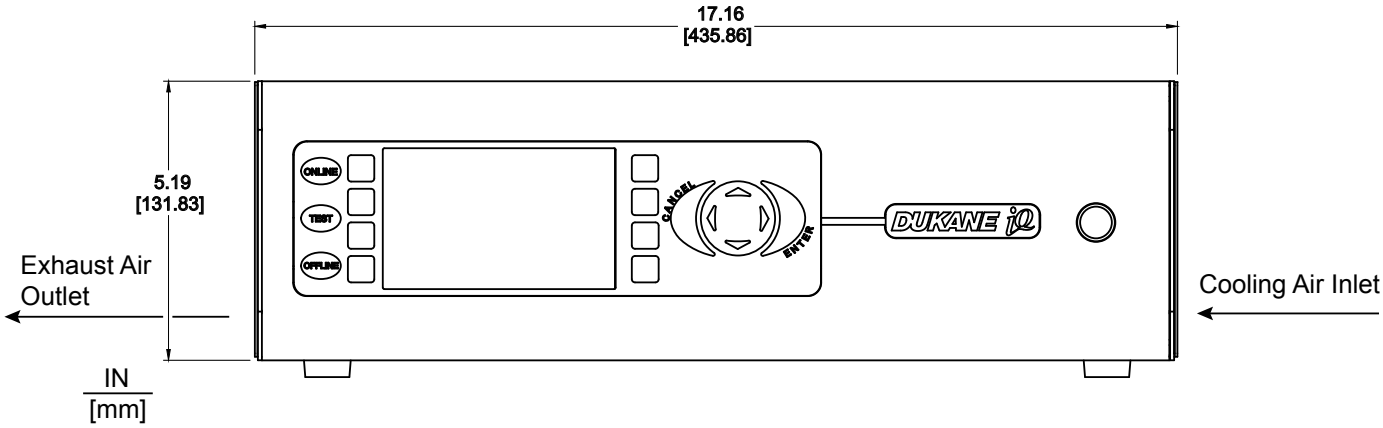

Figure 3-3 Generator Front View (Typical High Profile)

NOTE

Active Seismic Region Placement - If the generator will be put in an active seismic region, please refer to Application Note 511 at, ***http://www.dukane.com/us/DL_ApplData.asp***

Rear Panel Layout Overview

This section provides an overview of the generator rear panel layout, which includes panel areas dedicated to various standard system functions and options that are available. Figure 3-4 illustrates a typical panel layout.

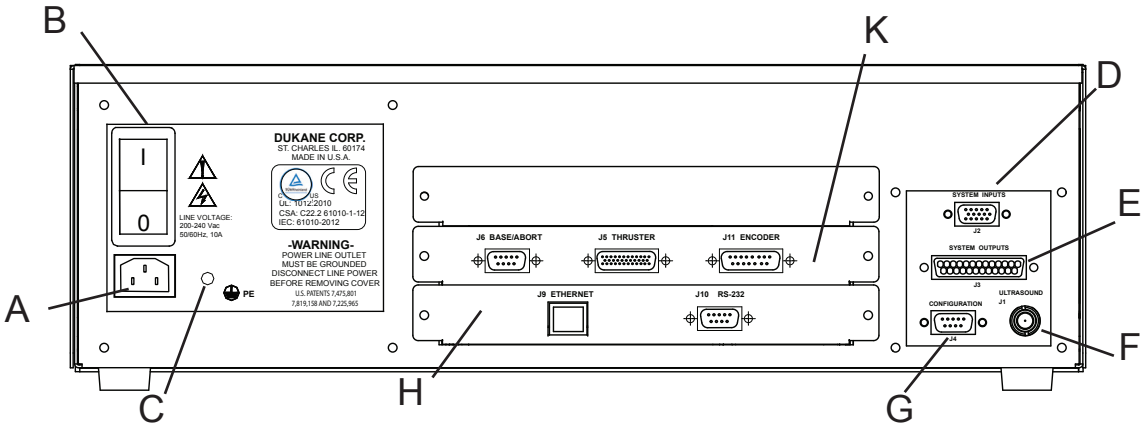

Figure 3-4 Generator Rear Panel - Pneumatic Press/Thruster

AC Power Inlet Panel

A IEC Power Inlet Connector – Attaches to an IEC style power cord.

B Power Switch – Circuit Breaker – Used to switch system power ON and OFF.

C Chassis Grounding Stud – Chassis connection for a protective earth ground.

The System I/O Panel

D System Input Connector (J2) – Connections for system control input signals.

E System Output Connector (J3) – Connections for system status output signals.

F Ultrasound Output Connector (J1) – Coaxial high voltage connection to ultrasonic stack.

G Configuration Port Connector (J4) – Digital control port to modify system parameters.

Options Module Panel

H Communications Board (See NOTE below.)

Shown in the example above are these ports:

J9 - Ethernet

J10 - Serial RS-232

K Press Interface Module (See NOTE below.)

Shown in the example above are these ports:

J6 - Base/Abort

J5 - Thruster

J11 - Encoder

NOTE

The press interface board is available in several different configurations.
See ***Section 9, Options*** for more information about Data Transfer using the Communications Board and more about the Press Interface Module.

AC Power Inlet Panel

The standard AC power inlet panel is described in this section.

IEC AC Power Inlet Connector

The IEC AC power inlet connector mounted on the system AC power inlet panel requires a properly configured IEC compliant power cord, which enables worldwide system operation by simply changing the power cord.

Low profile systems are equipped with a 10 amp rated IEC inlet connector. The high profile systems include a 16/20 amp rated IEC inlet connector. 120 VAC and 3600/4800W systems include a non-detachable power cord.

An appropriately rated power cord must be securely attached to the welding system's IEC inlet connector. If the correct power cord configuration is not included with the system for the local AC power outlet at your location, an appropriate IEC power cord should be available from a local electrical parts supplier. Note that the system undervoltage lockout will inhibit system operation if a North American power cord configured for 120V is connected to the system. A minimum of 180V is required for the system to operate.

Power Switch/Circuit Breaker

The power switch/circuit breaker has a rocker type actuator switch that will activate or deactivate the AC power to the system. The power ON position is marked with the internationally recognized **I** symbol, the power OFF position is marked with the **O** symbol. This power switch also integrates an appropriately sized over-current protection circuit breaker function in the generator.

If an over-current condition trips the circuit breaker, it will automatically switch to the OFF position. If the overload current that caused the circuit breaker to trip is due to a transient condition, the circuit breaker can be reset by switching the actuator back to the ON position. If when resetting the circuit breaker after it has tripped, it immediately trips again, there is likely an internal system malfunction, and the generator will require service.

Do not repeatedly try to reset the circuit breaker. If it trips, this will only cause more damage to the generator.

Chassis Grounding Stud

The chassis grounding stud is used to attach a protective earth ground to the generator. This will aid in the suppression of electrical interference or radio frequency interference (RFI) that is common in an industrial environment. The chassis ground stud is **C** in Figure 3-5. Proper system grounding is discussed on Page 9.

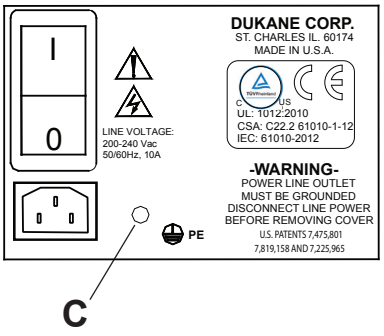

Figure 3-5 IEC AC Power Inlet Connector

System I/O Panel

The standard system I/O panel is described in this section. See Figure 3-6 on the next page.

System Inputs Connector

The SYSTEM INPUTS connector mounted on the system I/O panel includes connections for all of the basic system control input signals, that will typically come from an automated control system. The cable attached to this connector includes all of the available system control signals, which will be controlled by an output card or output port on the automation controller.

The user can determine which signals to use for each particular welding application, but there must be at least one connection to this connector in order to activate the ultrasound output. All of the input signals on this connector are electrically isolated (signals are NOT referenced to chassis ground) and activated when a 24VDC voltage source is connected to the signal input pin, referenced to the isolated common pin. The electrically isolated input signals can be driven from an automation controller output that is either sinking (NPN) or sourcing (PNP), depending upon how the isolated common connection is terminated. All inputs sink or source 10mA of current from a 24VDC power supply.

Continued

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Note that a simple switch closure (relay contact) connected to a control input can not activate the input without adding an external power supply to power the input. Adding jumper connections to pins available on the System Inputs connector, can configure switch closure inputs to operate referenced to generator chassis ground (non-isolated), without adding a separate power supply, if desired.

Refer to *Application Note AN507* (Automation Interface Guidelines) at ***http://www.dukane.com/us/DL_ApplData.asp*** for wiring diagrams of example applications.

System Inputs Connector Pinout

The SYSTEM INPUTS connector is a HD-15F (high density D-subminiature 15 circuit female) connector. Connector pin numbers for this connector are shown in Figure 3-7. The male connector on the cable is a mirror image of the panel-mounted connector and is shown in Figure 3-8. Table 3-I lists the signal names and descriptions, with more detailed descriptions that follow. The wire color coding for the system input cable is listed in Table 3-II, to assist with custom automation system wiring and assembly.

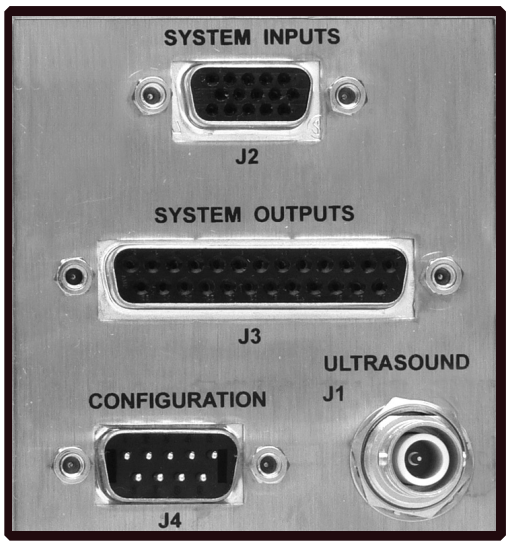

Figure 3-6 System I/O Panel (Standard Panel Shown)

NOTE

Refer to ***Section 9, Options*** for information on optional features.

Continued

Continued from Previous Page

Pin	Signal Name	Cable Color Code	Signal Option Requirements
1	+22VDC Power Supply	BLK	
2	+22VDC Power Ground	WHT	
3	Remote Setup Selection Bit 0 Input	RED	
4	Remote Setup Selection Bit 1 Input	GRN	
5	Remote Setup Selection Bit 2 Input	ORN	
6	Remote Setup Selection Bit 3 Input	BLU	
7	Remote Setup Selection Bit 4 Input	WHT/BLK	
8	Ultrasound Activation/Cycle Start Input	RED/BLK	
9	Not Used	GRN/BLK	Not Used
10	Front Panel Control Lock Input	ORN/BLK	Not Used
11	Press Inhibit for Hand Probes	BLU/BLK	Hand Probe
12	System Latch Reset Input	BLK/WHT	
13	Isolated Common	RED/WHT	
14	Not Used	GRN/WHT	Not Used
15	Automation Cycle Stop Input	BLU/WHT	

Table 3-I Generator Input Signals (J2)

System Inputs Signal Descriptions

Pin 1 (+22VDC Power Supply)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

Pin 2 (+22VDC Power Ground)

Pin 2 is the +22VDC return and is tied to the system chassis ground.

Pin 3 (Remote Setup Selection Bit 0 Input)

Pin 3 is the Remote Setup Selection Bit 0, which is the least significant bit used to select different welding setups with an automation control system.

Pin 4 (Remote Setup Selection Bit 1 Input)

Pin 4 is the Remote Setup Selection Bit 1, which is the second least significant bit used to select different welding setups with an automation control system.

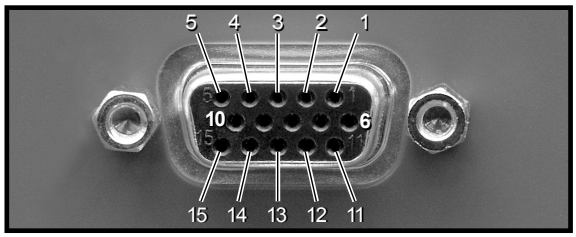

Figure 3-7 HD-15F, Generator Input Connector

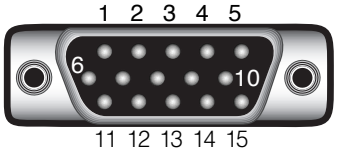

Figure 3-8 HD-15M, Generator Input Cable Connector

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Pin 5 (Remote Setup Selection Bit 2 Input)

Pin 5 is the Remote Setup Selection Bit 2, which is the third least significant bit used to select different welding setups with an automation control system.

Pin 6 (Remote Setup Selection Bit 3 Input)

Pin 6 is the Remote Setup Selection Bit 3, which is the second most significant bit used to select different welding setups with an automation control system.

Pin 7 (Remote Setup Selection Bit 4 Input)

Pin 7 is the Remote Setup Selection Bit 4, which is the most significant bit used to select different welding setups with an automation control system.

Pin 8 (Ultrasound Activation/ Cycle Start Input)

Pin 8 is used to activate the generator ultrasound output. Activation of this control input will switch the ultrasound output ON, and deactivating this signal will switch ultrasound OFF. This input signal will also function as a cycle start input, where the ultrasound activation and timing are completely under the control of the process controller. Depending on the welding process controller setup, this input signal could be activated momentarily (minimum of 50 ms) to start a welding cycle.

Pin 9 (Not Used)

Pin 10 (Not Used)

Pin 11 (Press Inhibit for Hand Probes)

Pin 11 is used to disconnect power applied to a press or thruster, if a hand probe is connected to the system input connector, for safety considerations. The hand probe activation switch could unexpectedly start a welding cycle that activates a press or thruster to the down position. The hand probe cable connector is wired to apply chassis ground to this pin, when it is attached to the system, which activates a press inhibit relay that disconnects power from the pneumatic press valves. This pin must be left open whenever a press control board is installed. Connecting this pin to chassis ground will inhibit press operation.

Pin 12 (System Latch Reset Input)

Pin 12 is used to reset the Any Fault or System Overload status outputs (See Status Output descriptions.). If a fault occurs during a weld cycle, these outputs will normally remain active until the next weld cycle is initiated. Activating this input will reset the status output faults and may simplify automation programming.

NOTE

Refer to ***Latch on Bad Part,*** on Page 50 for more information.

Pin 13 (Isolated Common)

Pin 13 is electrically isolated from chassis ground. Using isolated sourcing (PNP) output drivers, this common line would be connected to isolated ground potential. Using isolated sinking (NPN) output drivers, this common line would be connected to the isolated positive supply voltage output.

Pin 14 (Not Used)

Pin 14 is an open connection.

Pin 15 (Automation Cycle Stop Input)

Pin 15 is an input control signal that when enabled, can be used by the automation control system as a redundant signal to shut the ultrasound output off. This signal could also be reconfigured through menu selections to function as an automation end-of-weld control signal input.

Pin	Signal Name	Cable Color Code	Signal Option Requirements
1	+22VDC Power Supply	BLK	
2	Spare Output	WHT	
3	+22VDC Power Ground	RED	
4	Programmable Status Output 1	GRN	
5	Programmable Status Output 2	ORN	
6	Ultrasound Active Status Output	BLU	
7	Any Fault Status Output	WHT/BLK	
8	Press Trigger Status Output	RED/BLK	
9	System Overload Status Output	GRN/BLK	
10	System Online Status Output	ORN/BLK	
11	Press Top of Stroke Status Output	BLU/BLK	
12	Current Loop OK Status Output	BLK/WHT	Not Used
13	Analog Monitor Signal Common	RED/WHT	
14	Not Used	GRN/WHT	
15	Power Signal Monitor Output	BLU/WHT	
16	Amplitude Monitor Output	BLK/RED	
17	Programmable Status Output 3	WHT/RED	
18	MPC Ready Status Output	ORN/RED	Not Used
19	System Power OK Status Output	BLU/RED	
20	Bad Part Status Output	RED/GRN	
21	Good Part Status Output	ORN/GRN	
22	System Ready Status Output	BLK/WHT/RED	
23	Suspect Part Status Output	WHT/BLK/RED	
24	Isolated Common	RED/BLK/WHT	
25	Not Used	GRN/BLK/WHT	

Table 3-II System Output Connector Signals (J3)

System Outputs Connector

The SYSTEM OUTPUTS connector mounted on the generator I/O panel includes connections for all of the basic system status and monitor output signals, which will typically connect to an automated control system. The cable attached to this connector includes all of the available system output signals, which will be read or monitored by a digital input card or analog inputs on the user-supplied automation controller.

The user can determine which signals are appropriate for each welding application.

The system monitor output signals are analog signals used to monitor ultrasonic amplitude setting and ultrasonic output power levels, referenced to the Monitor Common (Pin 13).

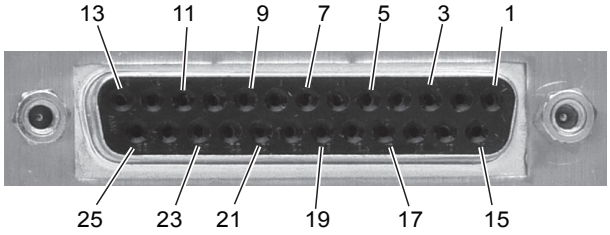

Figure 3–9 DB-25F, Generator Output Connector (J3)

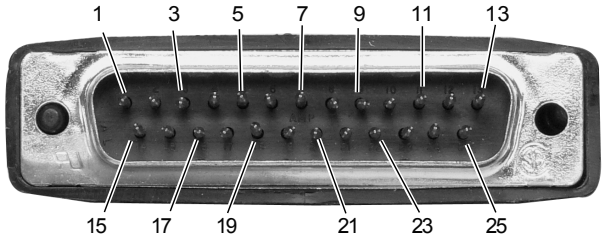

Figure 3–10 DB-25M, Generator Output Cable Connector

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This is at system chassis ground potential (non-isolated). All of the digital output status signals on this connector, are isolated (signals are not referenced to generator chassis ground). When a status output signal is activated, it will sink current (500mA Max. sourced by a 24VDC supply) to isolated common. In automation terms, the outputs are NPN (sinking) and would drive a PNP (sourcing) input that is referenced to the Isolated Common pin.

The digital status output signals can only sink current to isolated common. They cannot be changed to a sourcing (PNP) type output. If sourcing status outputs are required, there is an optional isolated NPN to PNP conversion module that is DIN rail mountable. The module converts the standard isolated sinking (NPN) status output signals to isolated sourcing (PNP) status output signals. Consult your local sales representative for information about the conversion module.

System Outputs Connector Pinout

The SYSTEM OUTPUTS connector is a DB-25F (standard D-subminiature 25 circuit female) connector. Connector pin numbers for this connector are shown in Figure 3-9. The male connector on the cable is a mirror image of the panel mounted connector and is shown in Figure 3-10. Table 3-III lists the signal names. Detailed descriptions are listed in *System Outputs Signal Descriptions* that follow. To assist with custom automation system wiring and assembly, the wire color coding for the system outputs cable is listed in Table 3-III.

System Outputs Signal Descriptions

Pin 1 (+22VDC Power Supply)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

Pin 2 (Not Used)

Pin 2 is an open connection.

Pin 3 (+22V Power Ground)

Pin 3 is the +22VDC return and is tied to the system chassis ground.

Pin 4 (Programmable Status Output 1)

Pin 4 is a digital active low status output that can be reassigned to other system status signals. The output can be assigned to E-STOP or Over Temperature.
[The Pin 4 default output: E-STOP.]

Pin 5 (Programmable Status Output 2)

Pin 5 is a digital active low status output that can be reassigned to other system status signals. The output can be assigned to Hold, In Cycle, or In Cycle with No Afterburst.

[The Pin 5 default output: Hold.]

Pin 6 (Ultrasound Active Status Output)

Pin 6 is a digital active low status output that activates when the system is delivering ultrasonic power to the load attached to the ultrasound output connector. This output will be an open circuit when the ultrasound output is off.

Pin 7 (Any Fault Status Output)

Pin 7 is a digital active low status output that activates whenever any fault condition is detected that inhibits ultrasound output and normal system operation. This output will be an open circuit when no system fault conditions are detected.

Generator faults that will activate the Any Fault output:

- Overload (Average, Peak, or Frequency)
- Overtemperature Fault
- System Power Fault

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Pin 8 (Press Trigger Status Output)

Pin 8 is a digital active low status output that activates when the specified trigger type has occurred. It will remain active until the thruster head raises to the top of the stroke. This output will be an open circuit when a trigger condition hasn't been detected.

Pin 9 (System Overload Status Output)

Pin 9 is a digital active low status output that activates whenever any overload condition is tripped. Activation of the overload status output signal could be caused by an average overload, a positive peak overload or a negative peak overload condition. After the overload status output activates, it will remain active until the next ultrasound activation cycle begins and this output will automatically reset. This output will be an open circuit when no overload conditions have been detected.

Pin 10 (System On-Line Status Output)

Pin 10 is a digital active low status output that activates when the system is in the ON LINE operating mode, which enables the activation of the ultrasonic output. This output will be an open circuit if the system is switched to the OFF LINE operating mode, which will prevent the start of a welding cycle or activation of the ultrasound output. Note that an automation controlled process can not weld any parts, if the system is, accidentally or otherwise, switched to the OFF LINE operating mode.

Pin 11 (Press Top of Stroke Status Output)

Pin 11 is a digital active low status output that activates when the press/thruster head is in the top of stroke position. This output will be an open circuit when the press/thruster head is not at the top of stroke position**.**

Pin 12 (Not Used)

Pin 13 (Analog Monitor Signal Common)

Pin 13 is the signal common (ground) connection for all of the analog monitor signals (on Pins 15 and 16). This signal common pin is connected to system chassis ground and is not isolated from the generator chassis. This is an analog signal ground connection. Do not connect anything to this ground connection, except the wiring to the inputs of the analog instrumentation devices used to measure the monitor output signals.

Pin 14 (Not Used)

Pin 14 is connected to the system chassis ground.

Pin 15 (Power Signal Monitor Output)

Pin 15 is an analog output signal used to monitor the power output from the welding system. The scaling on this output signal is as shown below:

15kHz, 20kHz, 30kHz and 40kHz systems

1 Watt = 0.001 VDC (1mV per Watt)

50kHz and higher systems

1 Watt = 0.010 VDC (10mV per Watt)

Examples: 20kHz system measures 0.525 VDC on Power Monitor Output = 525 Watts

50kHz system measures 0.525 VDC on Power Monitor Output = 52.5 Watts

Pin 16 (Amplitude Monitor Output)

Pin 16 is an analog output signal used to monitor the system amplitude setting. The scaling on this output signal is 100% amplitude = 10.0 VDC, or 0.1 VDC per 1% amplitude. This monitor signal output would typically be used when a remote control option board is installed in the system. The automation control system will adjust the system's amplitude setting remotely, using a 4-20mA current loop attached to the input of the remote control board. Using this monitor output, the control system can verify that the amplitude is set to the expected programmed amplitude level.

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Pin 17 (Programmable Status Output 3)

Pin 17 is a digital active low status output that activates when the system is regulating the amplitude level correctly. This output becomes an open circuit when the system falls out of regulation. When that happens, it can not adjust the system output to the output level that was programmed as the regulation set point.
This signal will be activated at the end of the ramp-up time until the beginning of the ramp-down time. This status signal will be active for the time the ultrasound is at the programmed amplitude setting.
The output can only be assigned to Amplitude Regulation Status.

Pin 18 (Not Used)

Pin 19 (System Power OK Status Output)

Pin 19 is a digital active low status output that activates when no fault conditions are detected by any of the power fault detection circuits included in the system. This output will be an open circuit when any power related fault is detected in the system.

Pin 20 (Bad Part Status Output)

Pin 20 is a digital active low status output that activates, either momentarily or until the start of the next welding cycle, when the welding parameters recorded during the previous welding cycle are outside of the programmed bad part limits. This output will be an open circuit when a bad part has not been detected.

Pin 21 (Good Part Status Output)

Pin 21 is a digital active low status output that activates, either momentarily or until the start of the next welding cycle, when the welding parameters recorded during the previous welding cycle do not exceed the programmed suspect or bad part limits. This output will be an open circuit after a welding cycle when either a suspect or bad part has been detected.

Pin 22 (System Ready Status Output)

This status output signal will activate only when the system is ready to activate ultrasound or begin a weld cycle. Pin 22 is a digital active low status output that activates when a weld processing cycle is completed and the welding process control system is ready to start the next welding cycle. This output will be an open circuit when the welding process controller determines that the next welding cycle cannot be started. This includes system faults or off line active, but not a process fault like Overload.

Pin 23 (Suspect Part Status Output)

Pin 23 is a digital active low status output that activates, either momentarily or until the start of the next welding cycle, when the welding parameters recorded during the previous welding cycle are outside of the programmed suspect part limits. This output will be an open circuit after a welding cycle when a suspect part has not been detected.

Pin 24 (Isolated Common)

Pin 24 is electrically isolated from chassis ground. This common line should be connected to negative output at a user-provided isolated 24VDC power supply. The isolated NPN status output signals can drive PNP inputs.

Pin 25 (Not Used)

Pin 25 is an open connection.

RFI Grounding

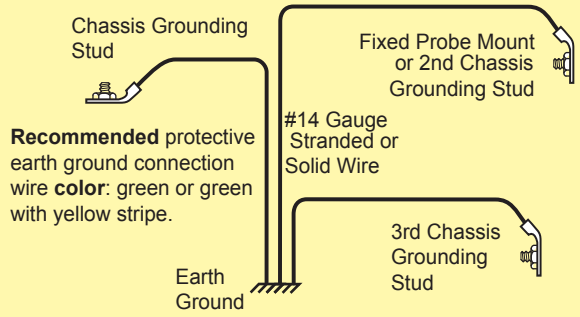
The ***iQ Series*** generator provides the operating power and power returns. Make sure the generator is grounded properly.

In addition to the safety considerations, proper grounding is essential for the effective suppression of RFI (Radio Frequency Interference). Every generator contains a RFI filter which blocks noise on the AC power line from entering the generator control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line.

If you experience problems with RFI from the press, run an additional grounding wire from the press base grounding stud to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. Use at least 14 AWG wire for the connection to the press base.

CAUTION

To minimize electrical noise and eliminate ground currents, ground the chassis as shown. Use a STAR configuration (illustrated below). Do not DAISY CHAIN the grounds.


Chassis Grounding Stud
Fixed Probe Mount or 2nd Chassis Grounding Stud
Recommended protective earth ground connection wire **color**: green or green with yellow stripe.
#14 Gauge Stranded or Solid Wire
3rd Chassis Grounding Stud
Earth Ground

Connector Descriptions

iQ Generator Connectors

J1 - Ultrasound Output Connector

The ultrasound output connector used with all standard generators is a high voltage (5000V) coaxial style SHV-BNC connector. This connector provides superior shielding of electrical noise, compared to other types of connectors. The ultrasound output connector mates with fully shielded coaxial ultrasound cables that are secured with a simple and reliable quarter-turn bayonet style attachment mechanism.

J2 - System Inputs Connector

The SYSTEM INPUTS connector includes connections for all of the basic system control input signals that will typically come from an automated control system. The cable attached to this connector includes all of the available system control signals, which will be controlled by an output card or output port on the automation controller.

The user can determine which signals to use for each particular welding application, but there must be at least one connection to this connector in order to activate the ultrasound output.

J3 - System Outputs Connector

The SYSTEM OUTPUTS connector includes connections for all of the basic system status and monitor output signals, which will typically connect to an automated control system. The cable attached to this connector includes all of the available system output signals, which will be read or monitored by a digital input card or analog inputs on the user-supplied automation controller.

The user can determine which signals are appropriate for each welding application**.**

Figure 3-11 Ultrasound Output Connector

CAUTION

The ultrasonic output from this connector (that drives the attached ultrasonic load) is a very high AC voltage (1200VAC). At high power levels this can exceed 2 amperes of current and must be securely terminated via the ultrasound cable for safe operation. Use original equipment ultrasound cables for safe and reliable system operation. Improperly assembled ultrasound cables can result in high voltage arcing and will destroy the ultrasound connectors.

Do not use your generator if there is any evidence of arcing (black carbon deposits) on either the ultrasound output connector or the ultrasound cable connectors.

NOTE

For details on integrating the welder with automation, refer to Application Note AN507 (Automation Interface Guidelines) at ***www.dukane.com/us > DL_ApplData.asp***

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J4 - Configuration Port Connector

The configuration port connector is a DB-9M (standard D-subminiature 9 circuit male) typically used for RS-232 serial communications. This serial port (DTE) connects to a serial port (DCE) on a computer via a standard 9-pin serial cable. If the computer does not have a serial port, you may use a USB-to-serial conversion cable.

This port is used for field updates to the generator firmware, without removing the enclosure cover. This port can also be used with a software application running on a Windows PC to modify the factory default system settings and hardware configurations. Contact your local sales representative for software availability information and access to documentation that will allow you to make use of the configuration port features.

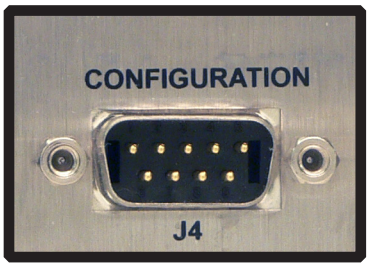

Figure 3-12 Configuration Port Connector

J6 - Base/Abort

The Base/Abort connector accepts the operate and emergency stop signals from the optical operate switches and abort switch on the base. If you are using custom automation, you may have separate operate and abort switches, but these still connect to this connector on the generator.

J9 - Ethernet

This port is used for Ethernet communication between the generator and HMI running ***iQ Explorer II*** software.

J10 - RS-232

This port is primarily used for welder diagnostic functions accessible via serial communication to a PC. Guidance will be provided by Dukane if the need to use the capability arises.

J11 - Encoder

This connector accepts signals from the distance encoder on the press.

J5 – Thruster

This connector is used to interface various control signals between the press and generator.

Power Cords

The AC line cords supplied with the standard generators are matched to the ultrasonic output power rating and the continent of specified use. See Table 3-III.

CAUTION

The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it is replaced with a properly grounded three-lead receptacle.

Have a qualified electrician do the replacement in accordance with the National Electrical Code and local codes and ordinances. DO NOT cut off the power cord grounding prong or alter the plug in any way.

Continent of Use	Power Cord Part Number	Power
North America	200 - 1110	240V, 15A
	200 - 1541	240V, 10A
Continental Europe	200 - 1111	240V, 16A
	200 - 1542	240V, 10A

Table 3-III Power Cords

Cable Connections

Reference: Cable numbers correspond with those used in Figure 3-13 and Table 3-IV.

1. **Grounding - Thruster and Press Base - Cables 8 and 9** respectively.
   Generator Chassis - Cable 10. (A supplied 14-Gauge wire, to be attached to the grounding stud. [See Figure 3-5 for stud location.])
2. **Ultrasound (J1) - Cable 3**. This output connects the Ultrasound Output of the ***iQ Series*** generator to the transducer, through a coaxial cable. The electrical welding signal is transmitted through this cable.
3. **Operational Control (J201) - Cable 1**. This cable runs from J201 on the thruster to the generator's Thruster connector (J5). The generator provides controls for triggering the weld, operating the thruster's pneumatic system, and providing 24 VDC operating voltage through this cable. The press driver card in the generator also provides monitoring for these functions.
4. **Encoder (J11) (Optional) - Cable 2**. The purpose of the encoder cable is to connect the distance encoder option to the generator's Encoder Port (J11).
5. **Ethernet Cable (J9) - Cable 5**. Connects to the HMI/PC, LAN port.
6. **RS-232 Cable (J10) -** Connects to a PC, RS-232 port.
7. **Base/Abort Cable (J8) - Cable 4**. Connects to the press base plate connector (J35) or an automation PLC**.**
8. **Connect the AC Power Cords: Cable 6**. To the HMI. **Cable 7**. To the IEC power inlet connector on the ultrasonic generator. Plug the other end(s) into an approved AC outlet.

CAUTION

The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it is replaced with a properly grounded three-lead receptacle.

Have a qualified electrician do the replacement in accordance with the National Electrical Code and local codes and ordinances. DO NOT cut off the power cord grounding prong or alter the plug in any way.

NOTE

Some connectors have a pair of threaded jack screws to secure the connector. Make sure the screws are snug, but do not overtighten them.

CAUTION

DO NOT operate the generator unless the ultrasound coaxial cable is connected and the transducer is installed in the thruster. Otherwise, an overload condition could occur, with possible damage to the generator.

Three Configurations

The ***iQ*** generator, ES models are configured in three basic ways:

1) With a pneumatic press/thruster
2) With a remote controller and a servo press/ thruster
3) With a servo press/thruster

The diagram and table that follow show the pneumatic configuration and list the cables used.

NOTE

For information about the ***iQ*** ES generator for servo systems, please refer to Dukane User's Manual, 403-587-00.

Pneumatic Press/Thruster

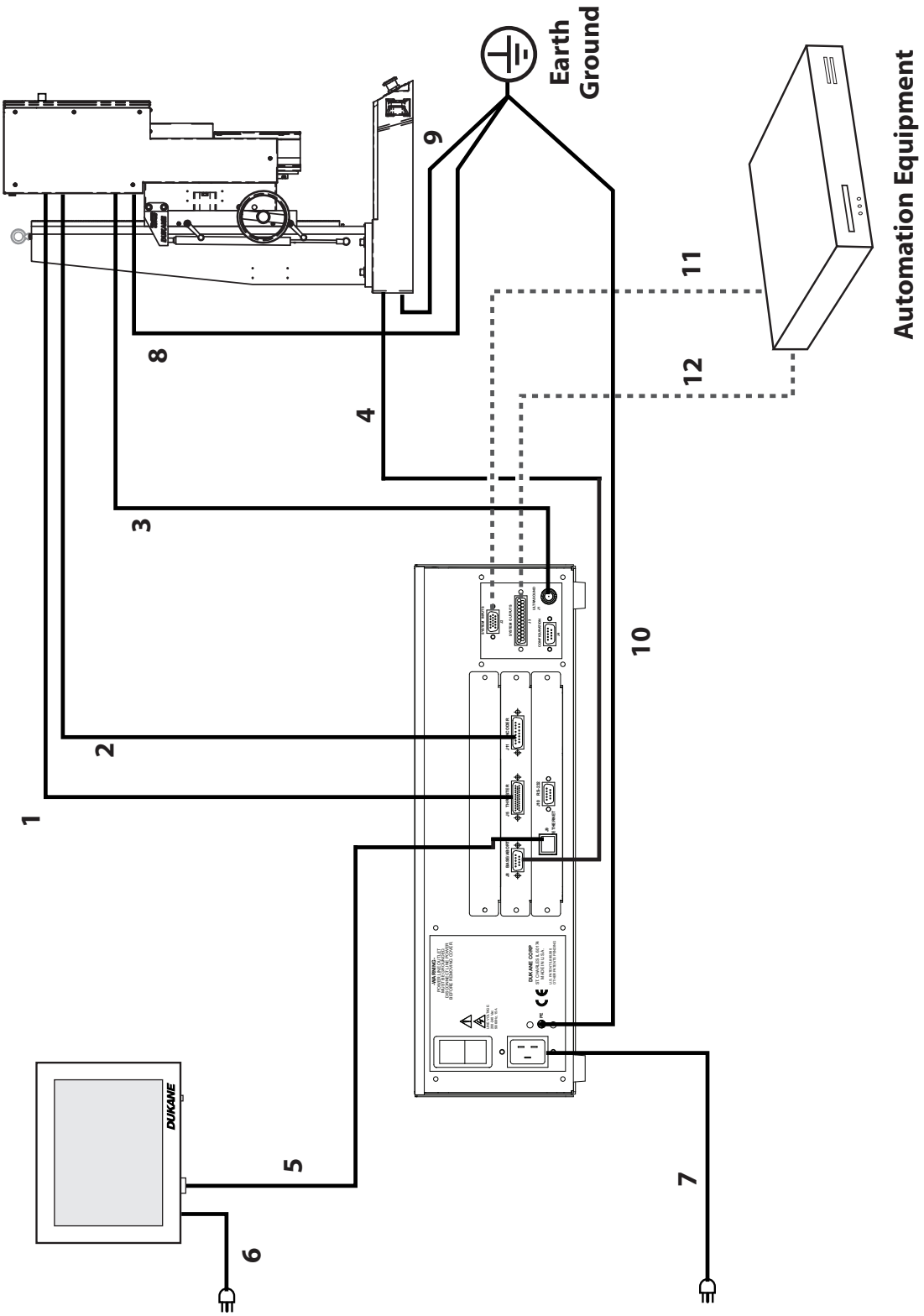

Figure 3-13 *iQ* Generator and Pneumatic Press/Thruster - Connections Diagram *Continued*

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Pneumatic Press/Thruster

Cable No.	Part Number	Length (Meters)	Connections			
			Generator	Base	Thruster	HMI
1	200-1556-XXM	XX	J5	-	OPERATIONAL CONTROL	-
2	200-1613-XXM	XX	J11	-	ENCODER	-
3	200-479-XXM	XX	J1	-	ULTRASOUND	-
4	200-1545-XXM	XX	J8	J35	-	-
5	200-1553-XXM	XX	J9	-	-	ETHERNET
6	One of the following: 200-1541 (240 VAC, 10A, US) 200-1542 (240 VAC, 10A, Europe) 200-1624 (240 VAC, 10A, India) 200-1576 (120 VAC)	2.4	-	-	-	AC INPUT
7	One of the following: 200-1110 (240 VAC, 15A, US) 200-1111 (240 VAC, 16A, Europe) 200-1612 (240 VAC, 15A, India) 200-1541 (240 VAC, 10A, US) 200-1542 (240 VAC, 10A, Europe) 200-1624 (240 VAC, 10A, India) (for 120 VAC models, power cord is integral to generator)	2.4	AC INPUT	-	-	-
8	200-1557	5	-	-	PE	-
9	200-1557	5	-	GRND	-	-
10	200-1557	5	PE	-	-	-
11	200-1380-XXM	XX	J2	-	-	-
12	200-1381-XXM	XX	J3	-	-	-

Table 3-IV *iQ* Generator and Pneumatic Press/Thruster Cables

Continued

Networking

Where several welders are connected, please refer to the ***iQ Explorer II*** *User's Manual*, 403-585-00. Refer to the Section on networking.

Among other things, there is information about connection through:

- Simple Stand-alone Configuration,
- Unique IP Address, and
- Connection to Local Area Network.

Recheck Connections

Recheck all cabling connections for the:

- ***iQ*** ES Generator
- Press/Thruster
- Connections to Local Area Network

Connect AC Power

When all cabling connections have been made, and they have been systematically rechecked, connect AC line power to your system.

WARNING

Any modifications to the Activation Switch (also known as the Operate Switch) circuit must comply with all OSHA and ANSI requirements. Compliance with all local building and electrical codes is also required.

Dukane Corporation does not assume any responsibility or liability for circuitry modifications made by the customer or by any third party manufacturer.

WARNING

Any modifications to the Emergency Stop Switch (also known as the E-STOP or Abort Switch) circuit must comply with all OSHA and ANSI requirements. Compliance with all local building and electrical codes is also required.

Dukane Corporation does not assume any responsibility or liability for circuitry modifications made by the customer or by any third party manufacturer.

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SECTION 4

Control Panel

Overview. 37
System Operating Mode Keys 38
Navigation Keys 39
System Power Output Level. 40
Screen Basics. 41

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Overview

This section introduces the ***iQ*** Series ultrasonic generator ES control panel and color display with this information:

- Functions of the panel components shown in Figure 4-1 below are discussed.
- Some screen basics are introduced:
  - — Making selections,
  - — Interpreting onscreen arrows,
  - — Using the virtual keyboard feature, and
  - — Taking a look at setup identification.

NOTE

Do not touch the display. Touch only the System Operating Mode Keys, the Navigation Keys and the Soft Keys to the left and right of the display.

Cleaning - If the display is dirty, clean it by first putting a mild cleaning solution on a clean, soft cloth. Then, gently wipe the cloth over the screen.

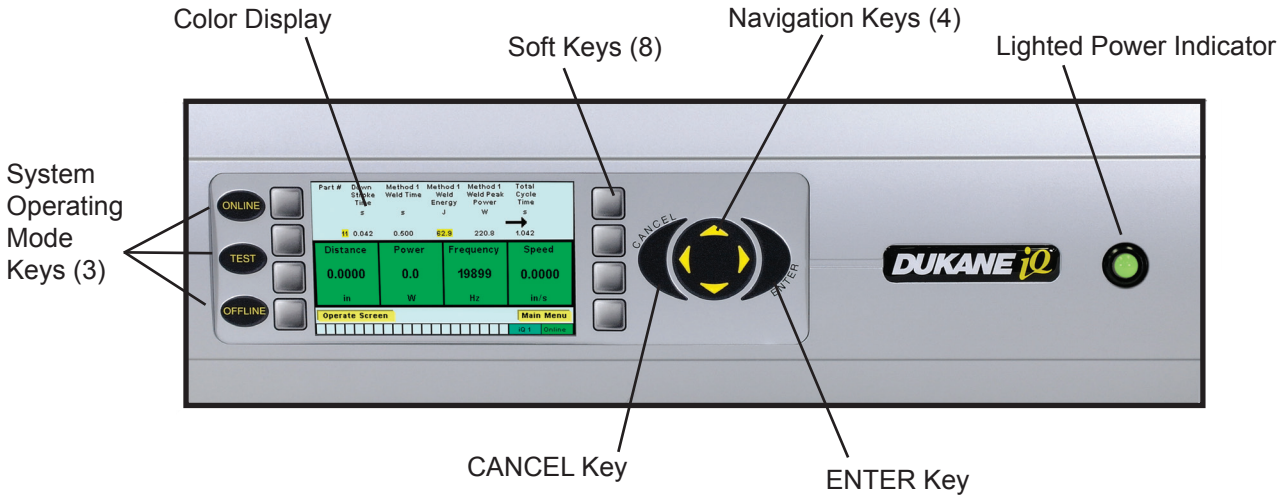


Figure 4-1 ***iQ*** Generator Display and Control Keys

System Operating Mode Keys

ONLINE - After AC power has been activated and the generator is operating normally, ONLINE is the normal operating mode. The generator can produce ultrasound signals in this mode.
The display has a WHITE background and the word, Online appears in a GREEN box in the lower right corner of the display.

TEST - After AC power has been activated and the generator is operating normally, in the ONLINE mode, the TEST key can be pushed.

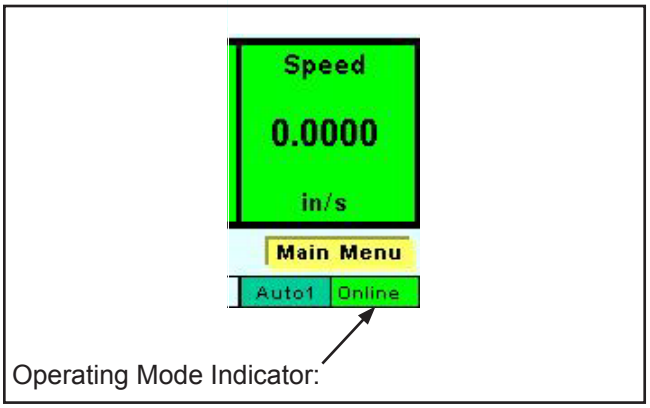
This activates a momentary ultrasound pulse allowing the operator to test system function. The display will show the real time settings for Amplitude, Power, and Operating Frequency.

This information is useful in troubleshooting.

OFFLINE - After AC power has been activated and the generator is operating normally, the OFFLINE key may be pressed to put the generator into the offline mode. In this mode the generator can not generate an ultrasound signal.

The display has a YELLOW background, and the word, Offline appears in a yellow box in the lower right corner of the display. See Figure 4-3 to the right.

The display has a RED background, and the word, E-STOP appears in a red box in the lower right corner of the display.



Online (green); Offline (yellow); or, E-STOP (red).

Figure 4-2 Display Detail, Operating Mode Indicator

CAUTION

If a transducer is not connected to the ultrasound output connector, the system should be set to the OFFLINE mode. Do not activate the ultrasound output without a transducer connected. Make sure that the stack is properly assembled before it is connected to the system. The horn should never come in direct contact with a metal fixture or anvil with ultrasound activated.

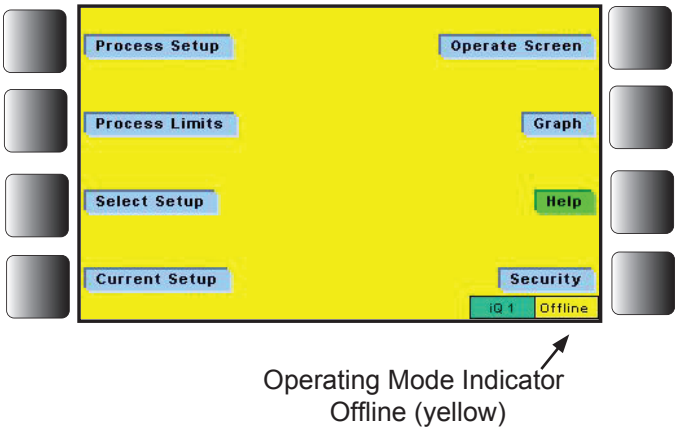


Figure 4-3 Generator in Offline Condition

Navigation Keys

Moving the Cursor - Press the **left and right navigation** keys to move the display's cursor left or right respectively.

Press the **up and down navigation keys** to move up one level in the menu, or to move back one level. Also, use the keys to change the value of a selected digit.

Enable/Disable - The navigation keys have another function. Any of the four keys can be pressed to either enable or disable a particular menu item.

See Figure 4-4.

ENTER Key

Press ENTER to confirm and store a selection in memory.

Example: After entering a time value, press ENTER.

CANCEL Key

Press the CANCEL key to return to the previous screen or cursor position. Think of it as a "back" key. Selection is not stored in memory.

Soft Keys Bordering the Display (8)

Use the eight keys that border the display to make selections from the choices shown on the display.

Not all keys will be active on any given screen.

Example 1: For the display shown on the right, three of the eight soft keys are active:

Administrator Password, **Erase**, and **Done**.

Example 2: At times the soft keys act like navigation keys to help move from screen to screen. In the example shown to the right, the two keys nearest the arrow (on either side of the display) will respond to an operator's touch. The arrows indicate more information is available - either left or right. In the example shown in the figure to the right, pressing the active soft key(s) will display more real time data. If the lower active keys are pressed, they will display the Operate screen (left) or the Main Menu (right).

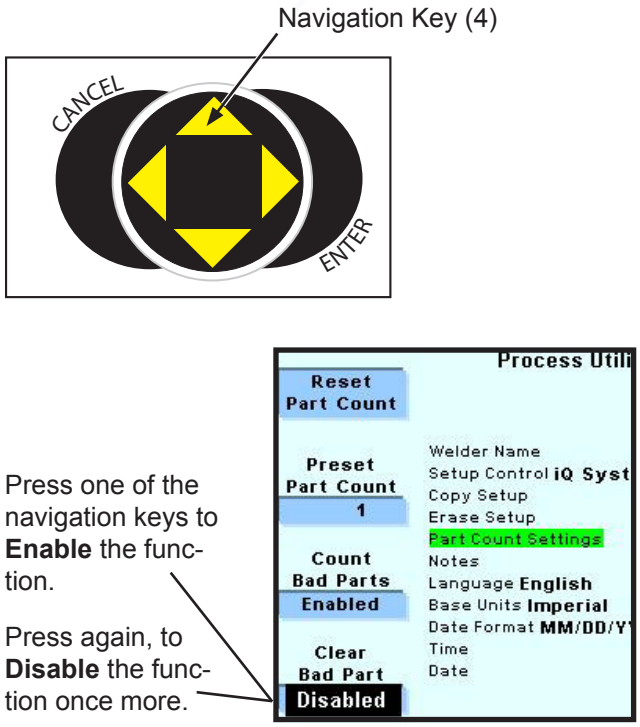


Figure 4-4 Navigation Keys (4), with Enter and Cancel

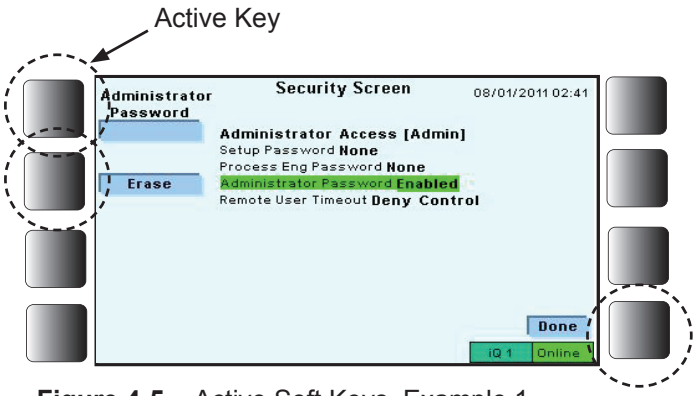


Figure 4-5 Active Soft Keys, Example 1

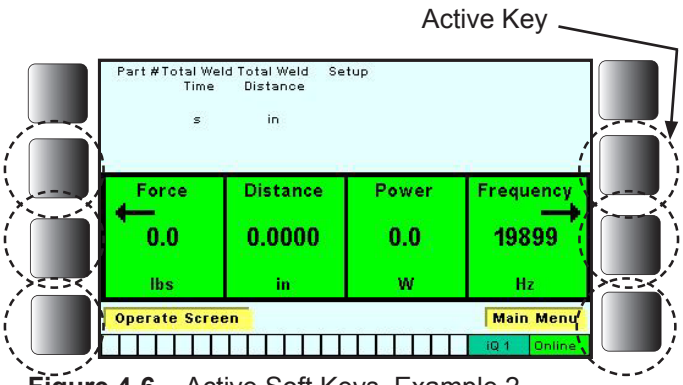


Figure 4-6 Active Soft Keys, Example 2

System Power Output Level (Bar Graph)

A bar graph displays the percentage of ultrasonic power being drawn by the load.

The display uses LED's that show:

GREEN - normal operation.

YELLOW - warning of potential overload.

RED - warning that an overload condition exists.

Peak Detect Feature

To indicate the maximum peak power achieved during a weld cycle, the LED in the bar graph corresponding to the peak level remains on (for about one second) after the weld cycle has been completed.

Flash on Overload at 90%

The OVERLOAD indicator begins to flash (RED) when the generator produces 90% of the overload power rating. This feature alerts the operator to an impending overload fault condition.

Bar Graph Power Scaling

Power scaling is related to amplitude. At 100% amplitude the whole graph is lit, and the generator is operating at 100% power. At 50% amplitude the entire graph is lit, and the generator is operating at 50% power.

If the amplitude setting is lowered, the graph rescales automatically according to the revised amplitude.

Example: With a 1200W generator, at 50% amplitude, if the whole graph is lit, that represents 600W.

Lighted Power Indicator

While the indicator glows GREEN, it shows that the generator has been powered by the AC current.

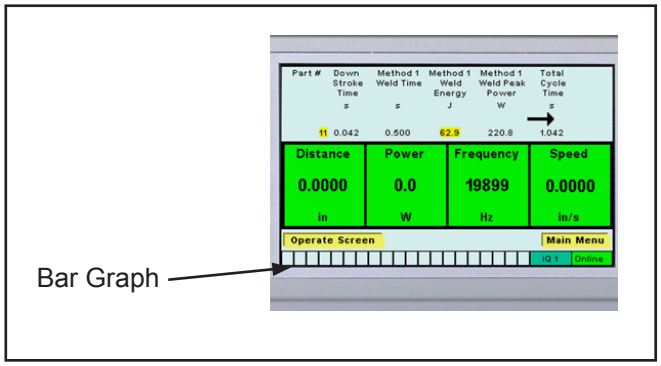


Figure 4-7 System Power Output Level, Bar Graph and Overload Indicator

CAUTION

If the System Output Power Level red overload indicator is lit, that means there is an overload fault. If this happens, verify that the ultrasonic stack is not damaged.

Screen Basics

Making Selections

Figure 4-8 shows there are several ways that an item has been selected:

- A word or phrase is bounded by a black border.
- A black box surrounds the selected item.
- A line of text is highlighted.
- The cursor shows what digit is selected.

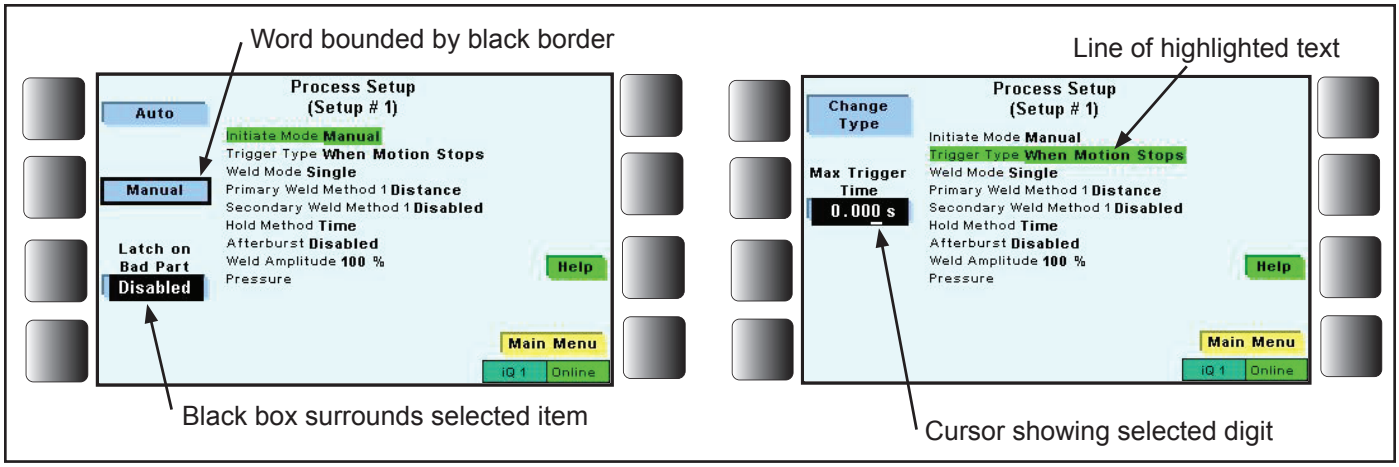


Figure 4-8 Making Selections

Interpreting Onscreen Arrows

Arrows pointing up, down, left and right give visual cues that more text is available in the direction the arrow points. Two examples are shown below. For the screen on the left, the up or down navigation keys are used. For the screen on the right, active soft keys are used. (See Figure 4-6.)

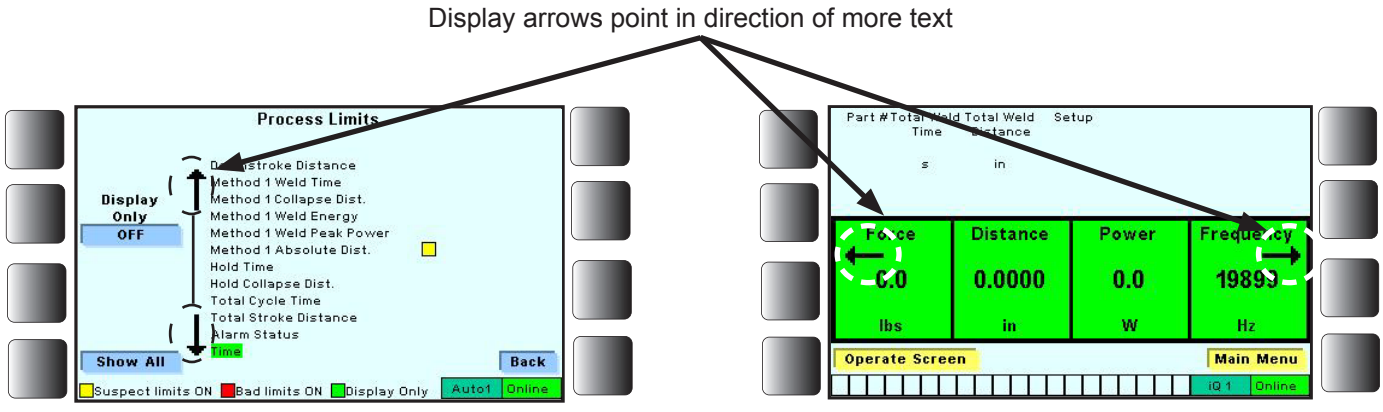


Figure 4-9 Arrows Indicate More Text

Virtual Keyboard

A virtual keyboard pops up when there is a need to make an entry for the Security and Hardware screens.

In the example shown below the operator is prompted to choose a Setup Name.

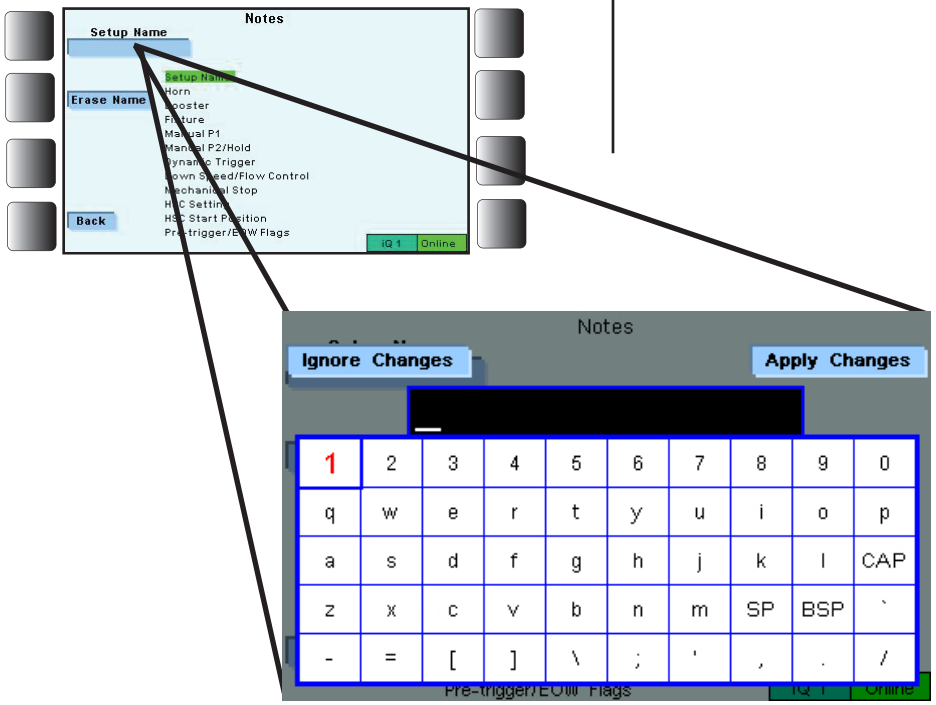

Notes
Setup Name
Erase Name
Back
Notes
Ignore Changes
Apply Changes
1 2 3 4 5 6 7 8 9 0
q w e r t y u i o p
a s d f g h j k l CAP
z x c v b n m SP BSP `
- = [ ] \ ; ' , . /

Figure 4-10 Virtual Keyboard

Setup Identification

Setup identification can be seen in the lower right corner of the screen.

The example shown in Figure 4-11 illustrates that setup control is by automation (Auto) and that Setup #1 program has been selected for the generator.

Setup can also be controlled by ***iQ*** System (***iQ***) or by sequencing (A pair of numbers that resemble a ratio such as 2:3 appears. In this example 2 is the number for the segment, and 3 is the number of the cycle in that segment.)

See Page 67 for more on Setup.

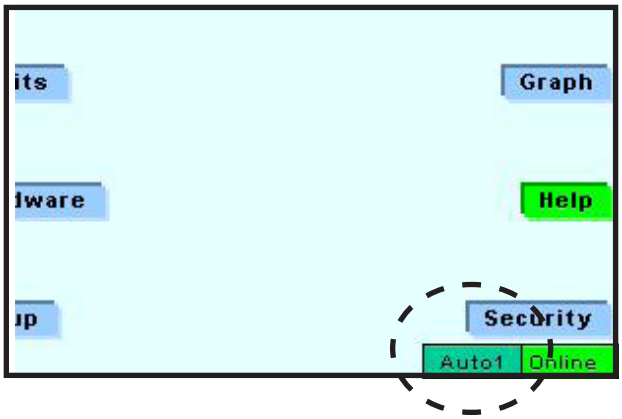


Figure 4-11 Main Menu Detail - Setup Identification

SECTION 5

Operation

Overview. 45
Generator Start-up Sequence 45
Stopping the Weld Cycle 46
Using the Menus. 47
Process Setup. 48
Process Limits. 66
Process Utilities 67
Hardware Setup 72
Operate Screen. 82
Graph 84
Help. 86
Security 87

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Overview

The ***iQ Series*** generator, model ES, is typically part of a system. Major system components would be:

- ***iQ*** generator,
- ***iQ Explorer II*** (software),
- User Interface (HMI),
  or computer (*user supplied*), and
- ***iQ*** Press System.

With this type of system, the user controls nearly all aspects of the welding process and has several choices of how best to accomplish this:

Control can be done through the color front panel of the ***iQ*** ES generator.

System control can also be done with the User Interface (HMI) or a computer (*user supplied*), using ***iQ Explorer II***.

NOTE

Press, acoustic stack, and tooling will require their own individual adjustments as those components are integrated into your particular system.

Helpful information on a wide variety of assembly equipment, processes and techniques can be found at the Dukane website:

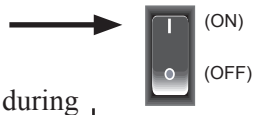
http://www.dukane.com/us/PPL_upa.htm

See ***Downloads*** for these User's Manuals:

- ***iQ Explorer II*** (Part No. 403-585-00), *and*
- ***iQ*** *Press System ES* (Part No. 403-569-00).

Generator Start-up Sequence

1. Press the rear panel AC breaker switch to ON.



2. The front panel lighted power indicator flashes during the start up sequence, then turns a steady GREEN (See Figure 5-1) when the generator is activated.

3. After the generator is activated, the LCD displays an image that identifies the Dukane ***iQ*** Series type. The sequence ends when the Main Menu screen is displayed as shown in Figure 5-2.

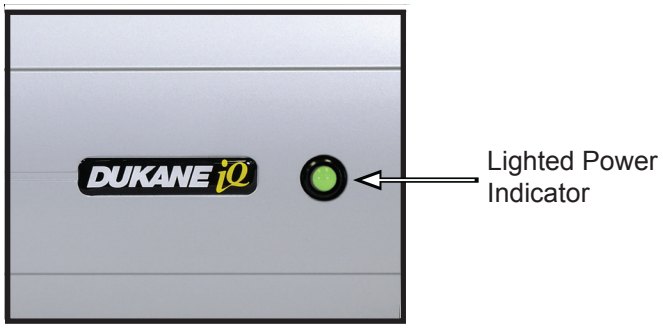


Figure 5–1 Front Panel's Lighted Power Indicator

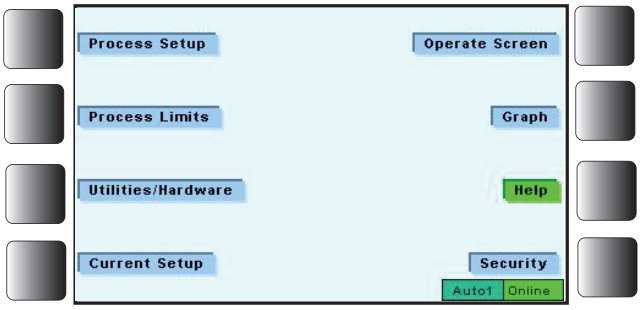


Figure 5–2 Main Menu Screen

Stopping the Weld Cycle

Normal Conditions

The cycle stops when the programmed welding cycle ends or when the rear panel's Cycle Stop input is activated.

Emergency Conditions

Push the power switch on the generator's rear panel to the OFF position. The front panel lighted power indicator goes out showing that power has been turned off.

Manual System

Do either of these things:

1. Press OFFLINE to stop the ultrasound signal. This may be done under any condition, OR
2. Push the power switch on the generator's rear panel to the OFF position.

NOTE

Automated System External Controls:
Customer-supplied external controls provide the means to stop the cycle for an automated system.
An auxiliary cable connects these external controls to the iQ generator at connector J2.
Activating the System Input called "Automation Cycle Stop" will stop the weld process or the complete cycle depending on if it's configured for "End of Weld" or "End of Cycle." See Page 20 for a description of Automation Cycle Stop Input.

Using the Menus

Navigation through the menus typically begins at the Main Menu. This menu can take two forms as shown below. If either the Administrator or Process Eng (Process Engineer) has logged in, the screen looks like that shown in Figure 5-3. If Setup has logged in, the screen looks like that shown in Figure 5-4.

The screens look identical with one exception:

The Administrator/Process Engineer screen has Utilities/Hardware while the Setup screen has Select Setup. Go to the pages referenced for more detail about each sub-menu.

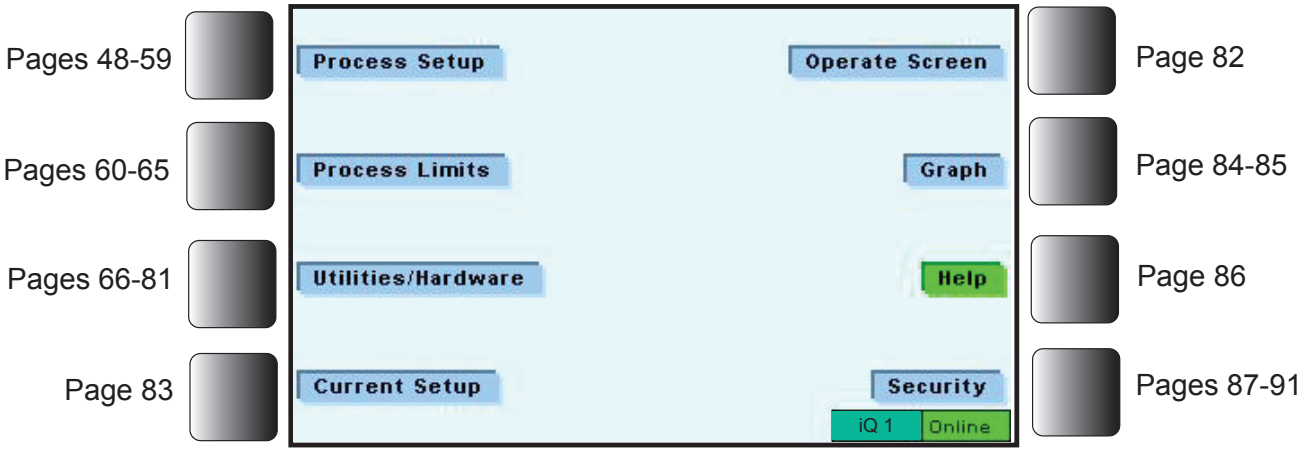


Figure 5–3 Navigating from the Main Menu (Administrator/Process Engineer Logged In)

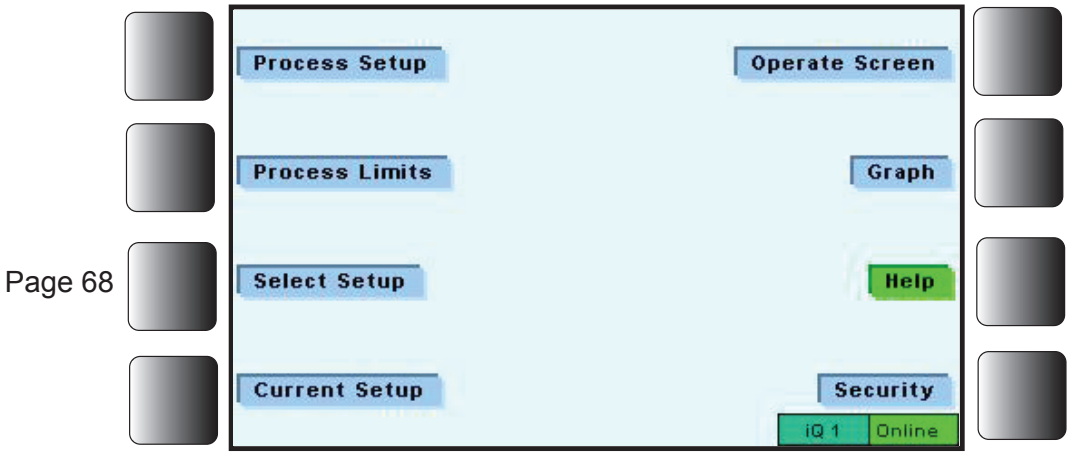


Figure 5–4 Navigating from the Main Menu (Setup Logged In)

NOTE

Security detail can be found on Pages 87-91.

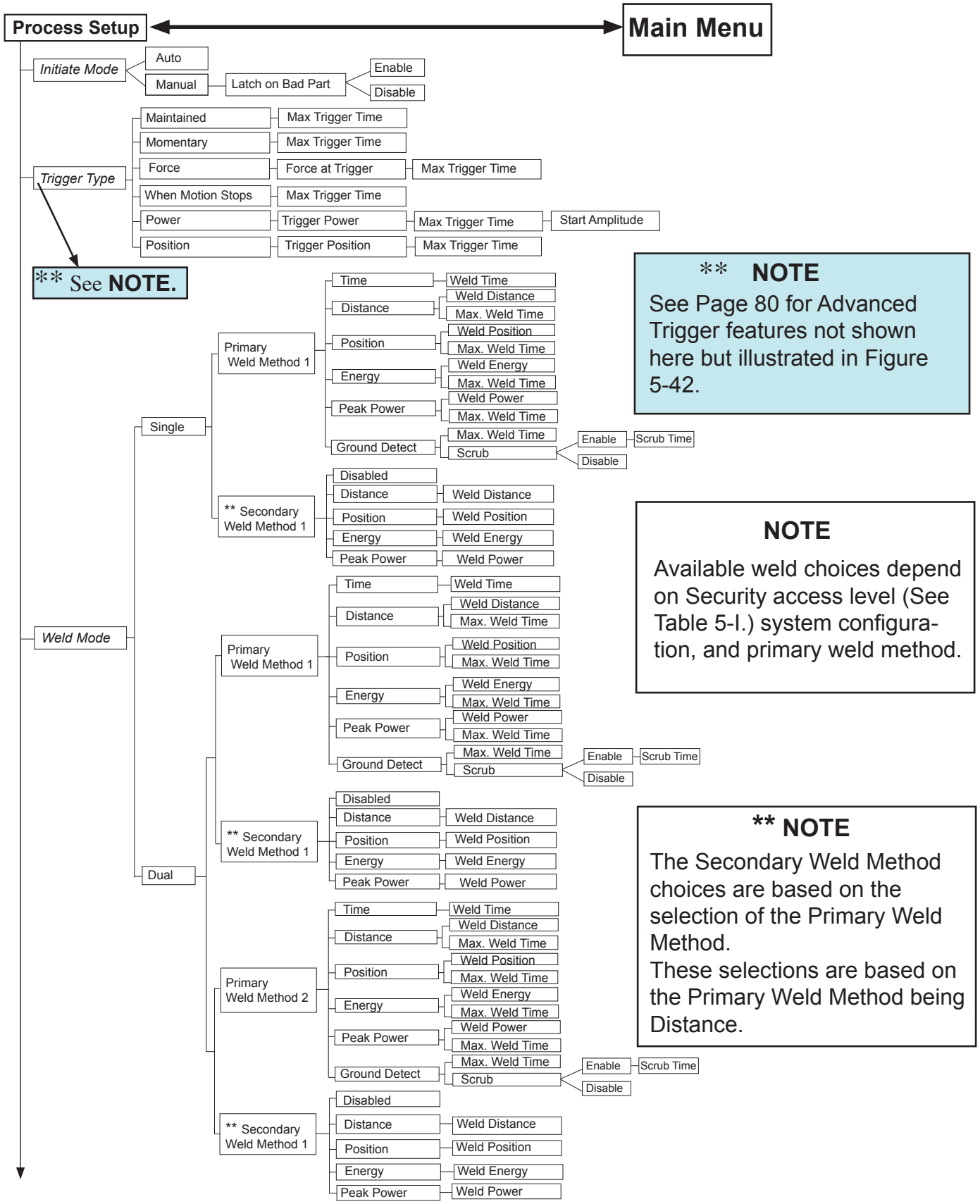


Figure 5–5 Process Setup Menu Diagram (1 of 2)

Process Setup, Continued

Process Setup, Continued from Previous Page

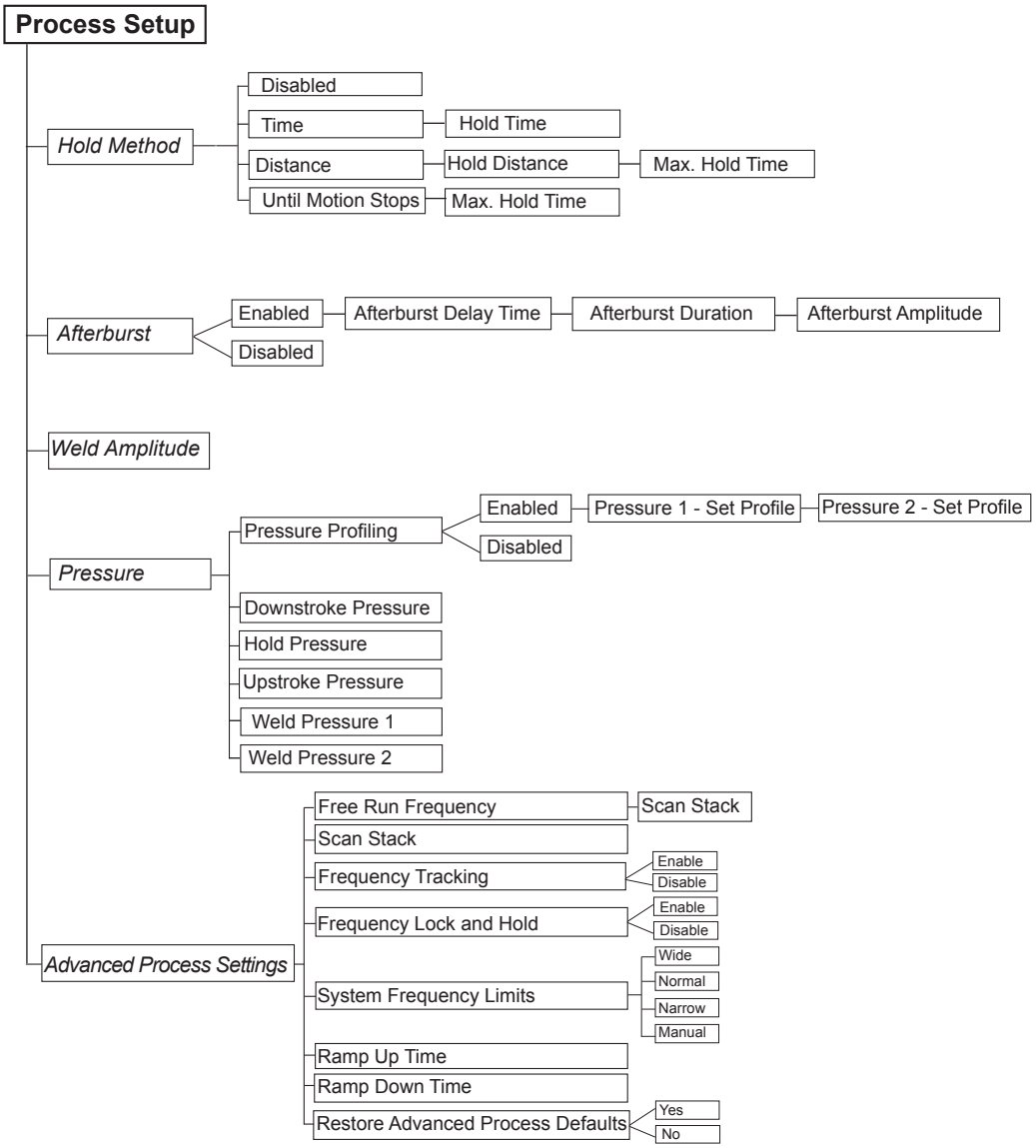


Figure 5-5 Process Setup Menu Diagram (2 of 2)

Process Setup, Continued

Process Setup

To gain a better understanding of Process Setup, please read this material.

The first of the Process Setup submenus is:

Initiate Mode

Initiate Mode controls the way a cycle is started, using either of two modes, Manual or Auto.

Manual

The cycle is started by depressing both operate switches on the press base (Operate Switch 1 and Operate Switch 2) within 0.35 seconds of each other.

Depress the operate switches continuously until the trigger switch on the press has activated or until the ultrasonic signal is applied.

Latch on Bad Part

When this feature is active (It is available only with the Manual Initiate mode.), the cycle stops when a bad part is detected, and SYSTEM LOCKED, Bad Part Limit Exceeded, LATCHED appears on the ***iQ*** display. The operator must deal with the LATCHED message before a new cycle will start.

The next cycle will not activate until the latch is cleared. There are two ways the latch can be cleared:

- **Remove the LATCHED Message from the Display**
  1. Go to the Main Menu.
  2. Go to Utilities, and then to Part Count Settings.
  3. Enable Clear Bad Part. (See Figure 5-6 to the right.)

When these three steps are completed, the operator can press the ENTER key to clear the latch, or

- **Activate the System Latch Reset Input**

The System Latch Reset Input signal (Pin 12 of J2, the System Inputs connector) can be activated.

See Page 20 for information about Pin 12 of the System Inputs (J2) connector. The pin can be used for latch reset.

Auto

The AUTO mode requires a voltage signal applied to J2 pin 8. The applied voltage level, either ground or +22VDC, must be the opposite of the voltage level applied to J2 pin 13. See Pages 19 and 20 for additional information.

Apply the auto input signal for a minimum of 50 milliseconds to ensure that the cycle has been started.

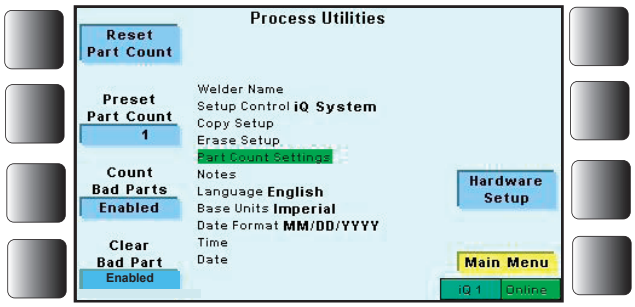


Figure 5-6 Enable Clear Bad Part

NOTE

What is a "bad part"? Bad part limits define what is considered to be a bad part.

If the **UPPER** limit of a selected characteristic is reached during its phase of the weld cycle, the weld process is stopped, and the part is identified as a bad part.

If the **LOWER** limit of a selected parameter is not reached by the end of its phase of the weld cycle, the assembly process is stopped, and the part is identified as a bad part.

See Page 64.

Process Setup, Continued

Process Setup, Continued from Previous Page

Trigger Type

Trigger Type is the next Process Setup submenu.

See Figure 5-7.

"Trigger" defines the type of event that turns on the ultrasound signal. This event can be:

- a contact closure from the trigger switch in the press,
- an absolute encoder position as in the case of pre-triggering,
- a velocity reached by the press.

NOTE

Pre-trigger and Trigger Delay information can be found on Page 80.

NOTE

Available trigger types depend on system configuration, and primary weld method.

Types can be:

- Maintained
- Momentary
- Force
- When Motion Stops
- Power
- Position

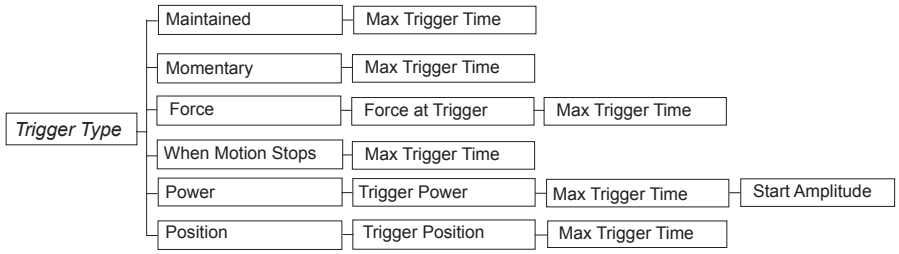


Figure 5-7 Trigger Type Submenu Diagram

Maintained - A *Maintained* trigger means that the trigger switch signal is active for the entire weld portion of the cycle. The signal comes from the trigger switch found on presses without an Electronic Pressure Regulator (EPR).

Momentary - With a *Momentary* trigger, the trigger switch signal is ignored after it has activated. If the trigger switch opens during the weld portion of the cycle, the weld continues normally. The signal comes from the trigger switch found on presses without an Electronic Pressure Regulator (EPR).

Force - If the ultrasonic press system has an electronic pressure regulator and load cell, the trigger type can be *Force*. The load cell takes the place of the mechanical trigger switch in the press.

When Motion Stops - When the downstroke velocity of the thruster reduces to zero, the ultrasound signal is triggered. Choose this trigger type when the operator wants the ultrasound signal to start as the horn has completely compressed the part to be welded. If the maximum trigger time is reached the weld is aborted and the press is returned to top of stroke.

NOTE

Available trigger types depend on system configuration, and primary weld method.

CAUTION

Use extreme caution when using the Momentary trigger type. Opening the trigger switch will NOT terminate the weld cycle. Guard the horn/fixture "pinch point" to prevent hands, or fingers from being crushed by the vibrating horn.

Process Setup, Trigger Type , Continued

Process Setup, Trigger Type, Continued from Previous Page

Power - Dukane has patented Trigger by Power. Go to Dukane's blog: ***http://usblog.dukane.com/2010/01/trigger-by-power-feature-aids-weld_27.html*** for more information about this feature.
During the downstroke, the ultrasound signal is immediately turned on with the Start Amplitude setting. When the power level reaches the trigger value, the weld amplitude is applied. Choose this trigger type when the operator wants the ultrasound signal to start as the horn touches the part to be welded. If the maximum trigger time is reached, the weld is aborted and the press is returned to top of stroke.

Position - The trigger source is via the distance encoder. When the position is reached the ultrasound signal is triggered.

Program Notes

After selecting the appropriate trigger type, the operator enters data where the trigger type calls for it.
For instance, all trigger types call for a Max Trigger Time to be entered.

Power calls for Trigger Power and Start Amplitude as well.

For Position, Trigger Position is required.
See Figure 5-7, Trigger Type Submenu Diagram.

Process Setup, Continued

Process Setup Continued from Previous Page

Weld Mode

Process Setup menu description continues with the Weld Method submenu.

Weld Method defines when the ultrasound signal is terminated after it has been triggered.

There are two methods of welding:

- Single (Single Pressure), and
- Dual (Dual Pressure)

Choosing one method automatically deactivates the other method.

Single

Single Pressure (Primary Weld Method 1) is a preset pressure applied to the part during the weld process. The pressure continues until the control parameter (Time, Distance, Position, Energy, or Peak Power) specified under the Weld Method submenu is reached.

Dual

When Dual Pressure is chosen, two separate pressures are applied to the part (Primary Weld Method 1 and Primary Weld Method 2) while the ultrasound signal is on. When the control parameter is reached for P1, the pressure changes to Pressure 2. The weld continues until the control parameter for P2 is reached (or a process characteristic moves outside its process limits). Control parameter limits set for the parameters are specific to each pressure.

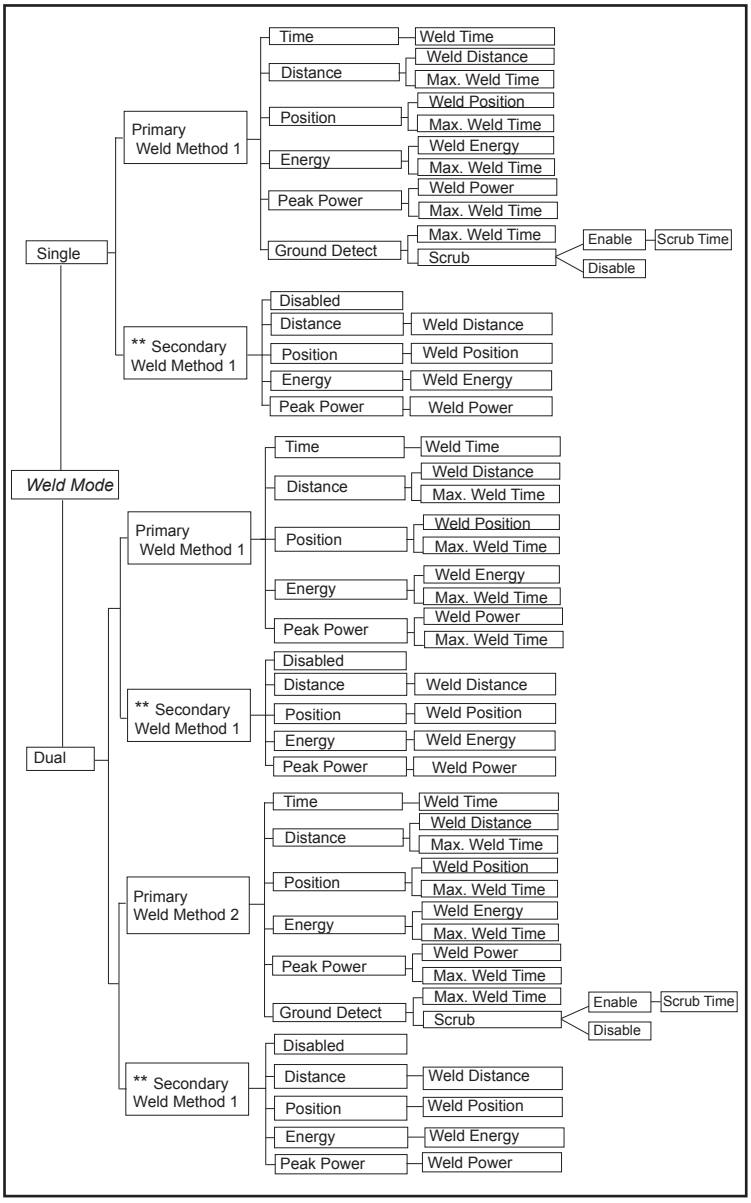


Figure 5–8 Weld Mode Submenu Diagram

Program Notes

After selecting the appropriate weld mode, the operator enters data where the weld mode calls for it. Figure 5-8 illustrates the weld mode submenu structure.

Process Setup, Weld Mode, Continued

Process Setup, Weld Mode, Continued from Previous Page

Control Parameters – Single and Dual Pressure Welding

Time

Welding by time means that the generator applies the ultrasound signal for a user-specified period. The range is from 0 to 99.999 seconds with a .001 second increment.

Distance (For Systems with Distance Encoder Only)

Welding by distance means that the generator applies the ultrasound signal until the press travels a user-defined distance from the trigger point. The range is from 0 to 7.0000 inches (0 to 177.800 mm) with a 0.0001 inch (0.001 mm) increment.

Position (For Systems with Distance Encoder Only)

Welding by position means the generator turns off the ultrasound signal after the horn travels a user-defined distance from the distance encoder reference mark. (This is independent of when the horn touches the part to be welded.)

Position terminates the ultrasound signal at the specified programmed distance.

Energy

With Energy as the selected weld control parameter, the system welds until the generator delivers a specified level of energy to the transducer while the horn is in contact with the part.

Energy, measured in joules, has a range of 0 to 100000.0, and has a 0.1 joule resolution.

Peak Power

With Peak Power as the selected weld control parameter, the system welds until the generator delivers a specified level of power to the transducer.

Peak Power, measured in Watts, has a 0.1 Watt resolution.

Peak Power range is dependent on the generator's maximum power rating.

Ground Detect

When Ground Detect is enabled the ultrasonic signal is shut off when the horn touches the isolated metal fixture during the welding process.

Scrub (when enabled) extends the weld time generated when the weld portion of the cycle is ended by the ground detect input. Typically this is used in cutting applications. Often the horn cuts through the material at a single point. This activates the ground detect input and ends the weld portion of the cycle.

There may be an incomplete cut however. Scrub time allows the cut to be completed by keeping the ultrasound signal on for a maximum of 127 milliseconds.

NOTE

MAX WELD TIME is a secondary characteristic of Distance, Position, Energy and Peak Power. The time forces the weld portion of the cycle to stop even if the specified control parameter is not met.

NOTE

Downstroke Distance = *Distance the horn travels until the ultrasound trigger point is reached.*
Weld Distance = *Distance the horn moves during the application of ultrasound to create the weld.*
Hold Distance = *Distance the horn moves during the hold or "cooling" portion of the weld cycle.*
Position = *Downstroke Distance + Weld Distance*.

Process Setup, Continued

Process Setup, Continued from Previous Page

Hold Method

The Hold Method determines in what way pressure on the part is held after the ultrasound signal has ended. Holding allows the material to solidify (under pressure) before the press head retracts. Hold Method choices are:

- Disabled,
- Time,
- Distance, and
- Until Motion Stops

See Figure 5-9.

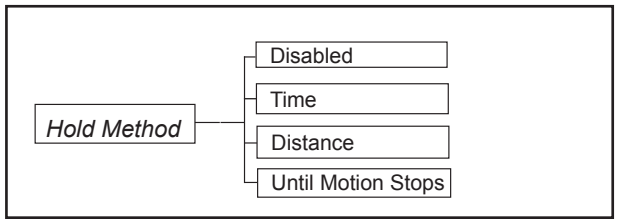


Figure 5–9 Hold Method Submenu Diagram

Disabled

Choose Disabled when no hold method is needed.

Time

The ***iQ*** generator will keep pressure on the part for the time period specified.

Distance (*For Systems with Distance Encoders Only*)

Holding by collapse distance involves keeping pressure on the part until a specified distance from the start of hold is reached.

As with the weld methods, to prevent the press from staying on the part indefinitely if the hold distance is not reached, a MAX HOLD TIME must be entered with this option.

Until Motion Stops (*For Systems with Distance Encoders Only*)

Pressure will be kept on the part until the speed of the press drops to zero. Like the weld methods, a user specified maximum time prevents infinite holding due to an unreachable distance.

Process Setup, Continued

Process Setup, Continued from Previous Page

Afterburst

In some applications the horn can stick to the part being welded as the head of the press retracts. Afterburst dislodges the part by sending a short burst of ultrasound on the upstroke.

Afterburst is defined by three values: the delay time, the duration of the afterburst, and by the amplitude. See Figure 5-10.

Delay is the time from the start of the upstroke until the start of the afterburst.

Duration is how long the afterburst ultrasound signal is on.

Amplitude defines the amplitude of the afterburst ultrasound signal.

The afterburst feature can be turned off by choosing DISABLE, or it can be turned on by choosing ENABLE.

When enabled, the delay and duration times and the amplitude are then entered.

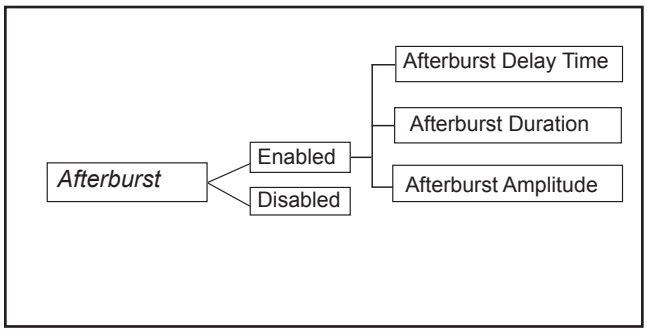


Figure 5–10 Afterburst Submenu Diagram

Weld Amplitude

The last parameter to enter is Weld Amplitude.

Amplitude refers to the peak-to-peak excursion of the horn at its workface.

Amplitude settings are given as a percent of the horn's nominal amplitude in the range of 20% - 100%.

Process Setup, Continued

Process Setup, Continued from Previous Page

Pressure

Figure 5-11 to the right diagrams the basic pressure submenu ***for systems with electronic pressure regulation.***

Pressure selections begin with a choice about Pressure Profiling. If Enabled, Pressure Profiling is explained on Page 58.

Pressure Profiling Disabled - With Pressure Profiling disabled, there are five pressures to be entered.

See Figure 5-12 to the right.

Downstroke Pressure - This is the pressure for the first part of the weld cycle (as the head begins to travel down towards the part to be welded). This is also the pressure responsible for triggering the ultrasound signal. When using force, more pressure may be needed to accomplish this.
Enter the Downstroke Pressure value.

Weld Pressure 1 - This is the pressure used in single pressure welding, and it is also the first of two pressures used with dual pressure welding. In presses with an electronic pressure regulator, this setting controls the air pressure.
Enter the Weld Pressure 1 value.

Weld Pressure 2 - This is the second pressure used during a dual pressure weld cycle. In presses with an electronic pressure regulator, this setting controls the air pressure. Enter the Weld Pressure 2 value.

Hold Pressure - Enter the pressure for the Hold portion of the weld cycle.

In presses without an electronic pressure regulator, the manual regulator setting controls the air pressure amount of the Hold portion of the weld.

Upstroke Pressure - This is the pressure for the final part of the weld cycle, as the head retracts. Enter the Upstroke Pressure.

NOTE

Manual Pressure Regulation - For systems without electronic pressure regulation, pressure adjustments are made with manual regulators on the front of the thruster.

The weld pressure values (1 and 2) can be added to the setup using the Notes feature found in the Utilities screen.

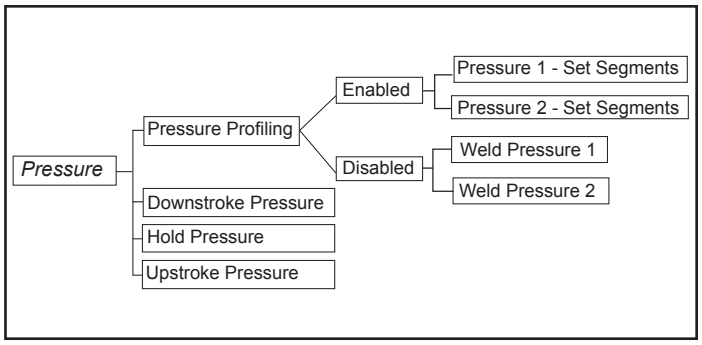


Figure 5–11 Pressure Submenu Diagram

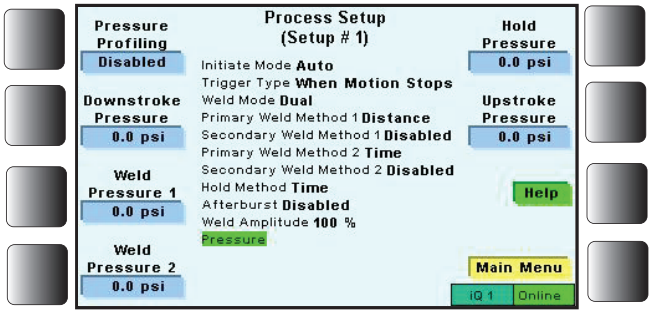


Figure 5–12 Pressure Profiling Disabled

Process Setup, Pressure, Continued

Process Setup, Pressure, Continued from Previous Page

Pressure Profiling - Up to ten different pressures can be programmed to occur during a single pressure weld cycle. If welding with dual pressure, the ***iQ*** generator can be programmed for up to twenty pressure steps.

With Pressure Profiling enabled, there are three single pressures to be entered, and two pressure profiles to create.

Figure 5-13 shows the display after Pressure Profiling has been enabled.

Downstroke Pressure - This is the pressure for the first part of the weld cycle (as the head begins to travel down). Enter the Downstroke Pressure value.

Pressure Profile Pressure 1 - These are the pressures used in single pressure welding, and it is also the first of two pressure profiles used with dual pressure welding.

Enter the Pressure Profile Pressure 1 values. Figure 5-14 shows a Pressure Profile Pressure 1 display and the profile points 1-10.

Enter the 10 values for the profile points, and press the DONE soft key.

Pressure Profile Pressure 2 - This is the second pressure profile used during a dual pressure weld cycle.

Enter the 10 values for the profile points, and press the DONE soft key.

Hold Pressure - Enter the pressure for the Hold portion of the weld cycle.

Upstroke Pressure - This is the pressure for the final part of the weld cycle, as the head retracts. Enter the Upstroke Pressure.

NOTE

Pressure profiling is only available when the press is equipped with the electronic pressure regulator feature.

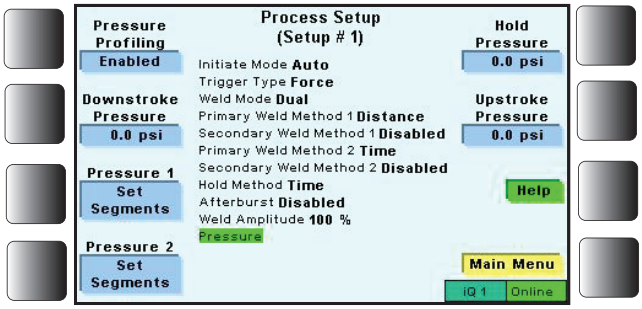


Figure 5–13 Pressure Profiling Enabled

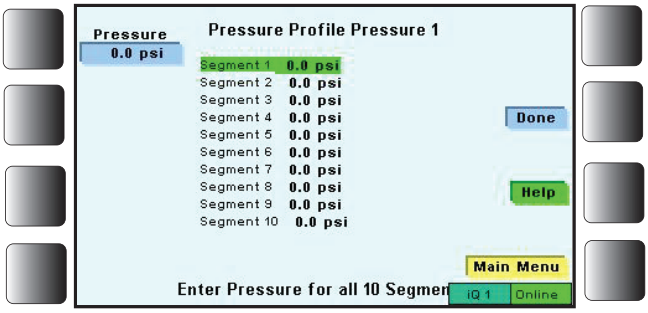


Figure 5–14 Pressure - Set Profile 1

Program Notes

Pressure profiling relates to how the weld method is programmed during setup.

EXAMPLE: If the total weld distance = 0.010 inch.

With a 10-step profile, each step equals one-tenth of the total distance. In this example, each step = 0.001 inch.

Process Setup, Continued from Previous Page

Advanced Process Settings

Advanced Process Settings are enabled through the Utilities/Hardware menu.
Please see Hardware Setup, Pages 76-81 for information on enabling these settings and for brief descriptions of each:

- Free Run Frequency and Scan Stack,
- Frequency Tracking,
- Frequency Lock and Hold,
- System Frequency Limits,
- Ramp Up, and
- Ramp Down.

Process Setup, Continued

Process Limits

Overview

As the weld cycle progresses, time, distance, power, and energy data are kept for each portion of the cycle. These measurements, also called *process characteristics,* create a process record for each part. Records' analysis can establish parts limits which then can be used to determine if the current process is "in control". The ***iQ*** generator can report the process characteristics as Bad or Suspect. The characteristics can also be displayed or printed without evaluation.

Limits are set using either statistical methods or physical system constraints. Statistical methods can be applied to pre-production parts that were evaluated for physical characteristics of quality (e.g., strength, appearance). Results of this evaluation are correlated to the process characteristics. Limits for the characteristics related to part quality are calculated. Other limits are determined by the system itself. For instance, Total Cycle Time limits may be established to end the cycle before an index table moves. Downstroke Distance may be set to detect a misload or incomplete assembly.

Available Process Characteristics

The list of available process characteristics is shown in Figure 5-15 on the following page. This is followed by brief descriptions of each characteristic.

NOTE

Of the available process characteristics, the ones that apply to a particular part depend on the current ***iQ*** setup for that part.

Process Limits, Continued

Process Limits, Continued from Previous Page

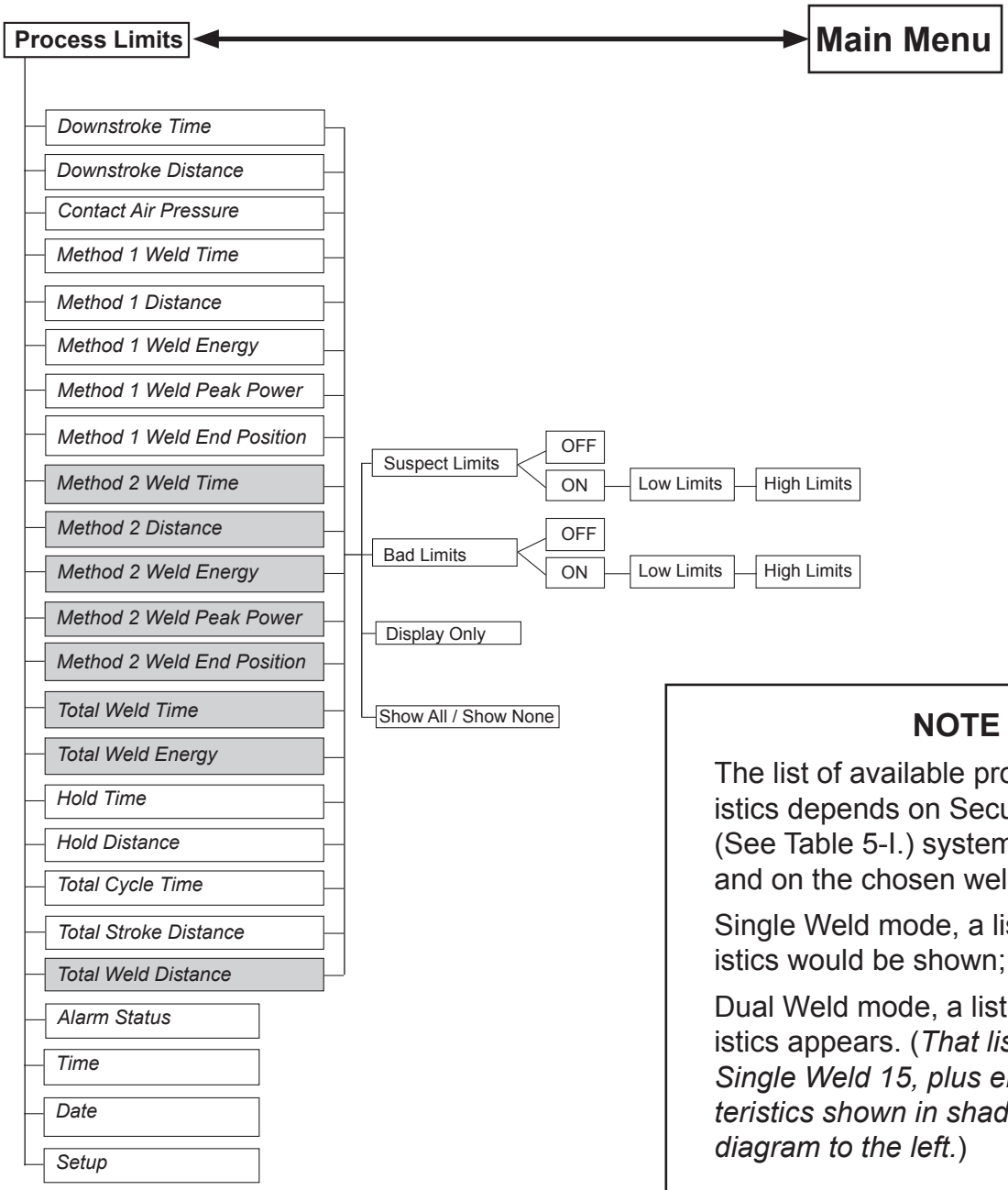


Figure 5–15 Process Limits Menu Diagram

NOTE

The list of available process characteristics depends on Security access level (See Table 5-I.) system configuration, and on the chosen weld mode:

Single Weld mode, a list of 15 characteristics would be shown;

Dual Weld mode, a list of 23 characteristics appears. (*That list includes the Single Weld 15, plus eight more characteristics shown in shaded boxes in the diagram to the left.*)

Process Limits, Continued

Process Limits, Continued from Previous Page

Process Characteristics Defined

Downstroke Time – This is the time from the start of the welding cycle to the trigger point.

Downstroke Distance (Distance Encoder Systems Only) – This is the distance from the distance encoder reference mark to the trigger point.

Contact Air Pressure (Electronic Pressure Regulator Systems Only) – This is a measurement of the line pressure at the trigger point.

Method 1 Weld Time – This is the length of time the ultrasound is applied to the part while Pressure 1 is applied to the part.

Method 1 Distance – (Distance Encoder Systems Only) This is the distance the press travels while the ultrasound signal is applied to the part during the first weld method.

Method 1 Weld Energy – This is the amount of energy drawn from the generator while the ultrasound signal is applied to the part under Pressure 1.

Method 1 Weld Peak Power – This is the highest instantaneous power delivered to the transducer during the Pressure 1 portion of the weld cycle.

Method 1 Position - This is the position relative to the reference mark of the mounted distance encoder at the instant of the end of weld method 1.

Method 2 Weld Time – This is the length of time the ultrasound is applied to the part while Pressure 2 is on the part.

Method 2 Distance - This is the distance the press travels while the ultrasound signal is applied to the part during the second weld method.

Weld Distance (Distance Encoder Systems Only) – This is the distance the press travels while the ultrasound signal is applied to the part under pressure.

Trigger Delay Time – The ultrasound signal can be delayed by a specified amount of time after the trigger switch has closed. This characteristic is set in milliseconds.

Trigger Delay Distance – The ultrasound signal can be delayed until the press travels a specific distance beyond the trigger point. This characteristic is set in inches.

Total Weld Distance (Distance Encoder Systems Only) – This is available when dual pressure welding is selected. It is the total of P1 and P2 weld distances.

Total Weld Energy – This is available when dual pressure welding is selected. It is the total of P1 and P2 weld energies.

Process Limits, Continued

Process Limits, Continued from Previous Page

Method 2 Weld Energy – This is the amount of energy drawn from the generator while the ultrasound signal is applied to the part under Pressure 2.

Method 2 Weld Peak Power – This is the highest instantaneous power delivered to the transducer during the Pressure 2 portion of the weld cycle.

Method 2 Distance – (Distance Encoder Systems Only) This is the distance the press travels while the ultrasound signal is applied to the part during the second weld method.

Total Weld Time – This is available when dual pressure welding is selected. It is the total of method 1 and method 2 weld times.

Total Weld Energy - This is the sum of energy drawn from the generator during weld method 1 and weld method 2.

Hold Time – This is the time the horn maintains pressure on the part after the ultrasound signal has stopped.

Hold Distance - This is the distance the press travels while maintaining pressure during the hold process, after the ultrasound signal has stopped.

Total Cycle Time – This is the period from the start of the weld cycle to the end of the weld cycle. The start of the cycle is defined as the point the auto input signal begins or when manual operate switches are closed. The end of the cycle is defined as the point the head retracts from the part.

Total Stroke Distance – This is the position relative to the reference mark of the mounted distance encoder at the end of the hold process.

Total Weld Distance - This is the sum of the collapse distances of weld method 1 and weld method 2.

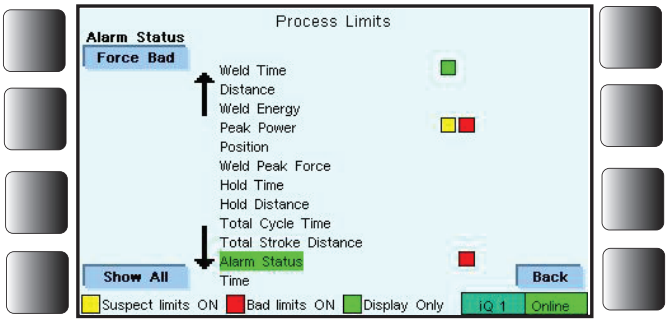


Figure 5–16 Process Limits - Alarm Status

Alarm Status – See Figure 5-16. This feature is included with the Part Limits menu to compliment part cycle data. It does this to show that a system alarm (www.dukane.com/us/DL_EasyAlarm.asp) was active during the weld cycle for a particular part.

There are four options with Alarm Status – one that disables the feature, and three other options that allow for the part record to show that an alarm was active.

Options:

1) Disabled – Alarm Status is off. If an alarm occurs, no signal will be generated for the welded part record.

2) and 3) Force Bad, or Force Suspect – The ultrasonic generator will provide a signal when a system alarm activates. The operator chooses whether to categorize the part under this circumstance as Suspect or as Bad. Whatever designation is given to the part, it will be carried on to become an item in the part record.

Figure 5-16 above shows with the red square symbol, that Force Bad has been chosen as the option for Alarm Status.

4) Display – Whenever a system alarm happens, the ultrasonic generator indicates this on the display's Operate screen. A square green indicator appears alongside the term Alarm Status. This is a visual cue to the operator. The part record will not have this information.

Time – This is the current time of day according to the ***iQ*** generator timer.

Date – This is the current date according to the ***iQ*** generator timer.

Setup – This is the number of the current setup.

Process Limits, Continued

Process Limits, Continued from Previous Page

Data from Process Characteristics

Data from each weld cycle can be monitored through the available process characteristics.

Programming choices for each characteristic are:

— No Display

— Display Only,

— Bad Limits, and

— Suspect Limits.

No Display

Figure 5-17 shows that Method 1 Weld Energy is the selected process characteristic, and no choices have been made for that characteristic. Weld characteristic is not displayed.

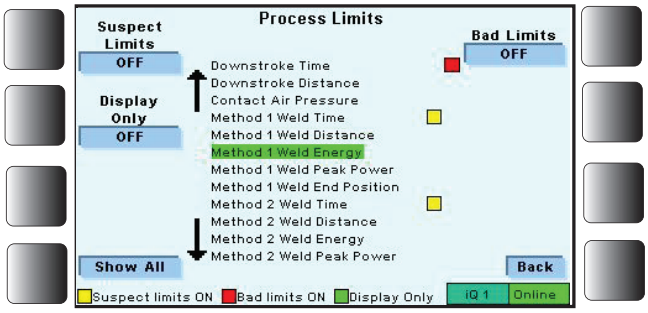


Figure 5–17 Process Limits - No Choice

Display Only

Figure 5-18 shows Display Only was chosen for the Setup process characteristic.
That process characteristic is displayed during normal operation using the Operate screen.

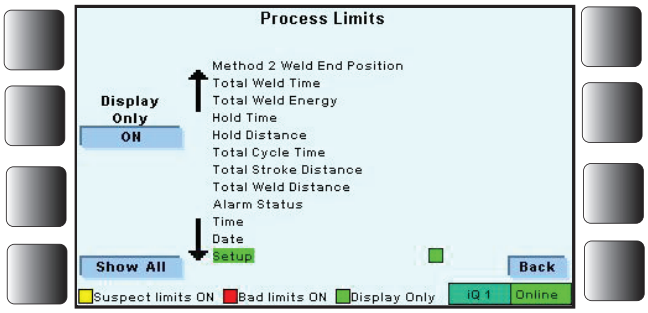


Figure 5–18 Process Limits - Display Only

Bad Limits

This is also known as Bad Part Limits.

Figure 5-19 shows that Downstroke Time is the selected characteristic. Bad Limits are ON, and Low Limits and High Limits need to be set.

The Bad part limits are used to establish boundaries that define unacceptable results for parts that are being processed. If a bad limit is either not met or is exceeded, the weld cycle is ended immediately, and the operator is notified in these ways:

• Two beeps are given (if buzzer is set to ON).

(See Buzzer, Page 79.)

• The *iQ* ES bad part output is activated.

• BAD is displayed in the part cycle data.

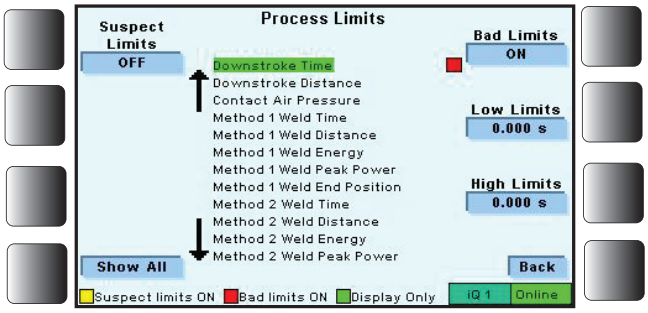


Figure 5–19 Process Limits - Bad Limits

Process Limits, Continued

Process Limits, Continued from Previous Page

Suspect Limits

This is also known as Suspect Part Limits.

Suspect part limits detect out-of-limit conditions without ending the weld cycle. These limits are used when process characteristics are grouped within a "gray area" between good and bad. Parts can be sorted as good, bad, and suspect. Suspect parts can be inspected manually. Suspect limits can also be used as a form of pre-control in applications where statistical process control methods are being used.

When a suspect part limit has not been met or that it was exceeded, the operator is notified in these ways:

• One beep is given (if buzzer is set to ON).

(See Buzzer, Page 79.)

• The ***iQ*** ES suspect part output is activated.
• SUSPECT is displayed in the part cycle data.

In Figure 5-20 the selected characteristic is Method 2 Weld Distance.

Both Suspect Limits and Bad Limits are ON for which both Low Limits and High Limits need to be entered.

Part Cycle Data

The weld characteristics chosen to be displayed can be seen in real time using the Operate Screen.

See OPERATE SCREEN on Page 82.

Show All

Notice that Figure 5-20 indicates there is an active soft key for the selection: Show All.

Press this key to display all process characteristics.

Show None

After pressing the Show All soft key, the key designation changes to Show None.

Press the key so that none of the process characteristics are displayed.

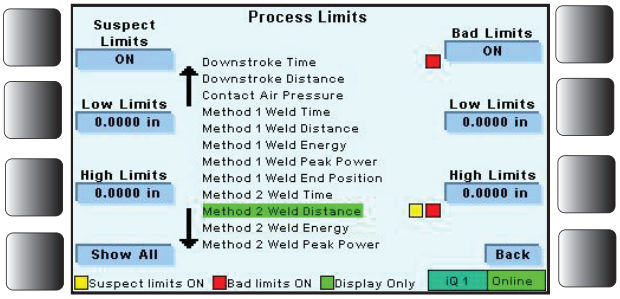


Figure 5–20 Process Limits - Suspect Limits

NOTE

Change your mind?

If you change your mind and decide not to display all of the characteristics, press the *Show None* soft key, to turn off the display feature for all of the characteristics.

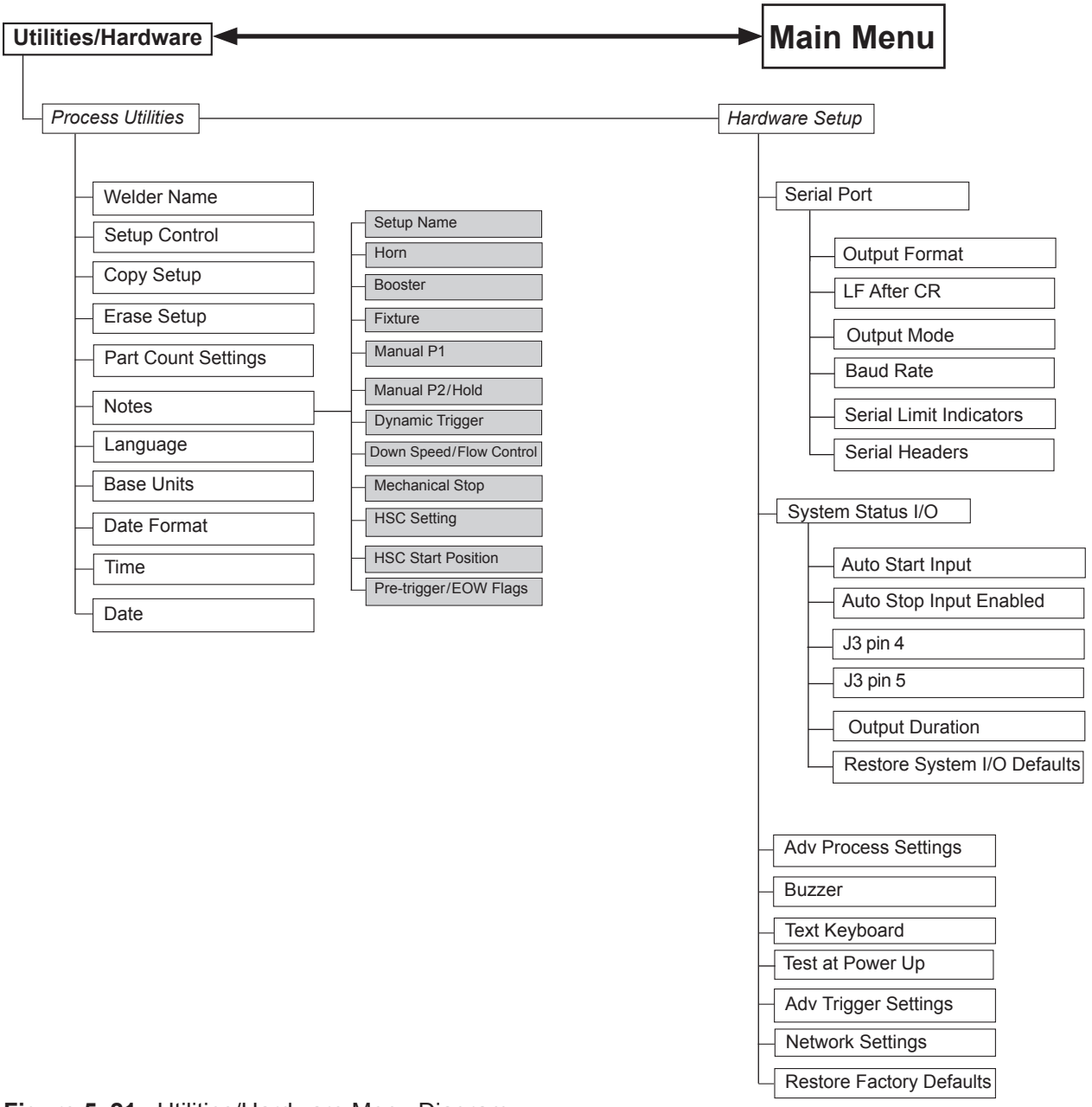


Figure 5–21 Utilities/Hardware Menu Diagram

NOTE

The list of available Process Utilities and Hardware items depends on Security access level (See Table 5-I.) and on system configuration.

Process Utilities, Continued

Process Utilities, Continued from Previous Page

Process Utilities

Overview

Process Utilities provides setup management and part tracking tools. Notes are included to allow unique names to be given to many setup components.

Setups and their components can be identified. This information can be used to recall setup conditions.

Figure 5-22 shows that, with the exception of Notes, there are 10 utilities to consider. Review the brief descriptions of these utilities below:

Welder Name

Use the virtual keyboard to give the welder its own identification.

Setup Control

Setup Control defines where control for setup originates: with the iQ System, with Automation, or with Sequencing.

Select a Method of Control - When the soft key Change Method is pressed, an image like the one shown in Figure 5-23 appears.

Choose from three methods that define where control for a particular setup originates:

iQ System - Control originates through the ***iQ*** generator and its program.

Sequencing - Control originates through the sequence definition as programmed through the ***iQ*** generator.
See more on Sequencing in Appendix C.

Automation - Control originates with equipment external to but in communication with the ***iQ*** generator.

If Sequencing is selected, then the screen shown in Figure 5-25 appears. Typically, Define Sequence would be chosen.

Defining the sequence involves entering the information suggested by Figure 5-25: Sequence Length, etc.

For more on Sequencing, go to Appendix C.

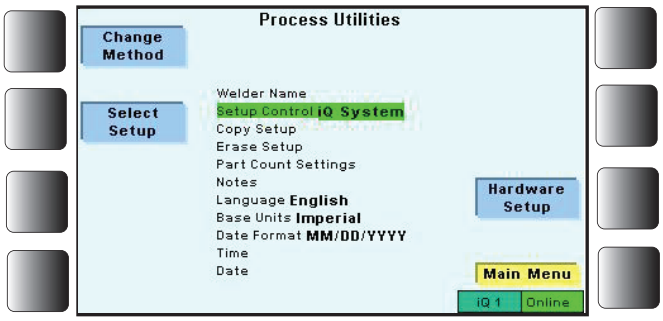


Figure 5–22 Setup Control

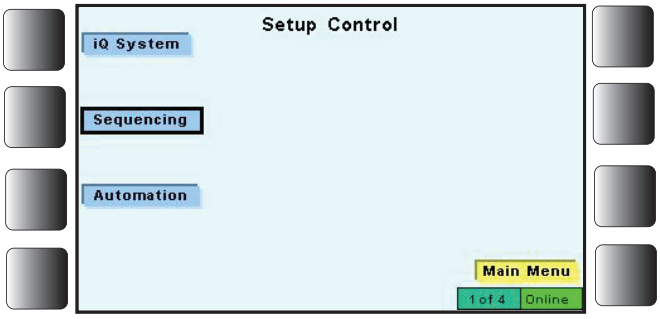


Figure 5–23 Setup Control - Select a Method

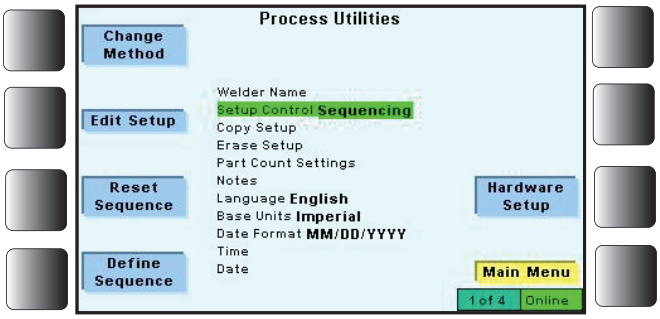


Figure 5–24 Setup Control - Sequencing Chosen

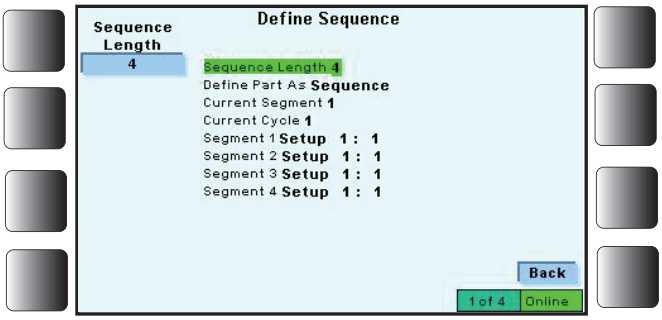


Figure 5–25 Defining the Sequence

Process Utilities, Setup Control Continued

Process Utilities, Setup Control, Continued from Previous Page

Choose a Setup

Choosing a setup depends on two factors:

Setup Control, and Security Access

Setup Control - Using Setup Control through the Process Utilities menu, the three types of control deal with setup selection in these ways:

- iQ System - Press the Select Setup soft key. (See Figure 5-22.)
- Sequencing - Press the Edit Setup soft key. (See Figure 5-24.)
- Automation - Press the Edit Setup soft key. (See Figure 5-26.)

After pressing the Select Setup or Edit Setup key, a Choose Setup screen like the one shown in Figure 5-27 is displayed.

Then, highlight a setup from the setup number list.

Next, press the Choose Setup soft key to confirm the choice.

Security Access - If Security access has been established, then menu access can be limited depending on what Security access level is active.

If the Setup Security is active, then the main screen would look like it does in Figure 5-28 to the right.

To choose a setup in this case, press the Select Setup soft key.

As with System Control, a list of setups is displayed. Highlight a setup from the list and press Choose Setup.

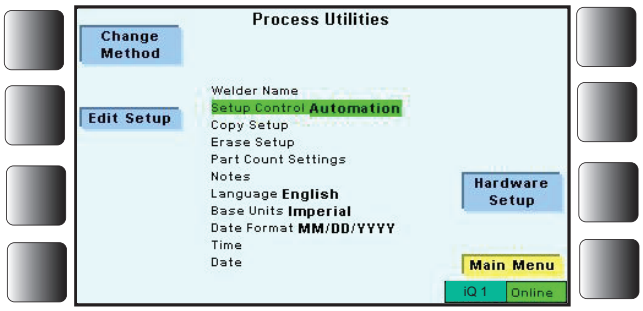


Figure 5–26 Setup Control - Automation Selected

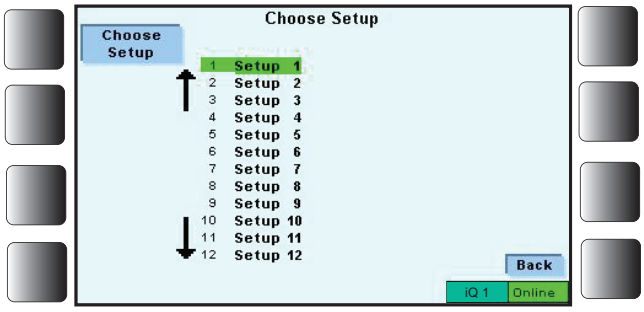


Figure 5–27 Setup Control - Choose Setup

NOTE

Read the Security material starting on Page 84 for more information.

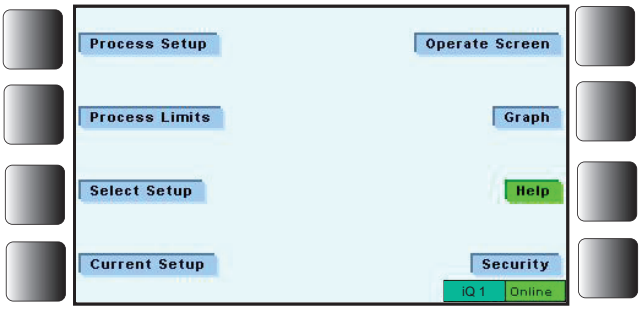


Figure 5–28 Select Setup - When Setup Security Access is Active

Process Utilities, Continued

Process Utilities, Continued from Previous Page

Copy Setup

This feature allows data from one setup to be copied to another setup. In Figure 5-29 to the right, Copy Setup is selected from the Process Utilities list.

Press the Copy Setup soft key, and the display shown in Figure 5-30 appears.

Choose setups: Copy From, and Copy To.

Then press the soft key, Press Here to Copy.

The display will appear as it does in Figure 5-31.

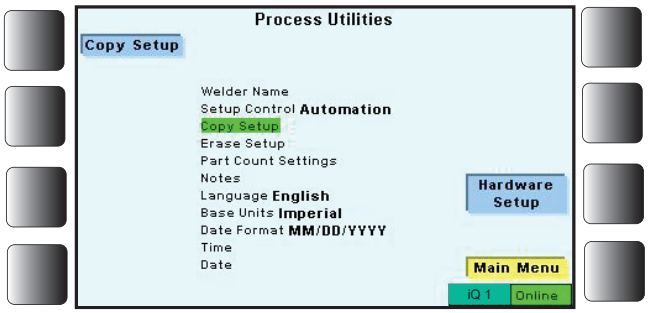


Figure 5–29 Copy Setup - 1

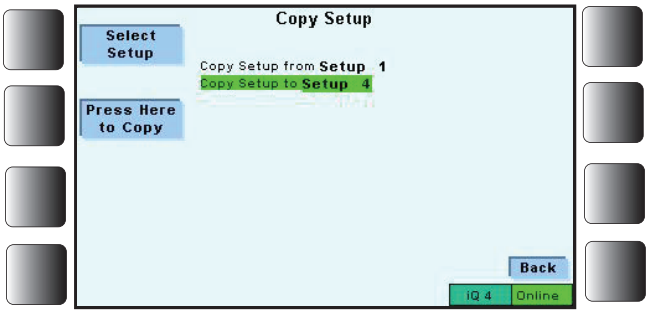


Figure 5–30 Copy Setup - 2

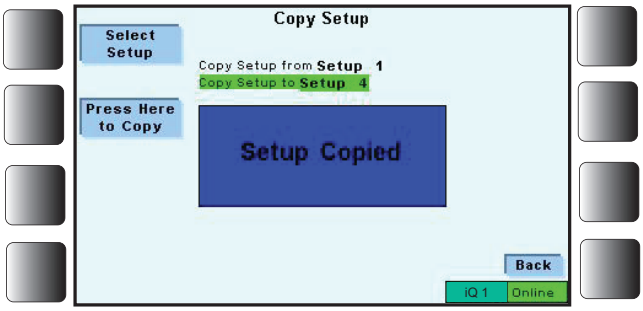


Figure 5–31 Copy Setup - 3

Process Utilities, Continued

Erase Setup

Setup data can be erased for the current setup, or for all setups. See Figure 5-32.

Part Count Settings

This utility permits part count modification through its three submenus: (See Figure 5-33.)

Reset Part Count - Selecting this sets the part count to zero (0).

Preset Part Count - Enter a number that starts the part counter.

Count Bad Parts - Enable this to increment the part count if a bad part occurs.

Language

Choice of language displayed by the front panel is made through this utility.

Base Units

Select either Imperial or Metric units with this display utility.

Date Format

The date utility allows for three ways of displaying the date: MM/DD/YYYY, DD/MM/YYYY, or YYYY/MM/DD

Time

This utility is used to set the time, in the 24 hour format.

Date

Entering the current date will be done in the date format already chosen.

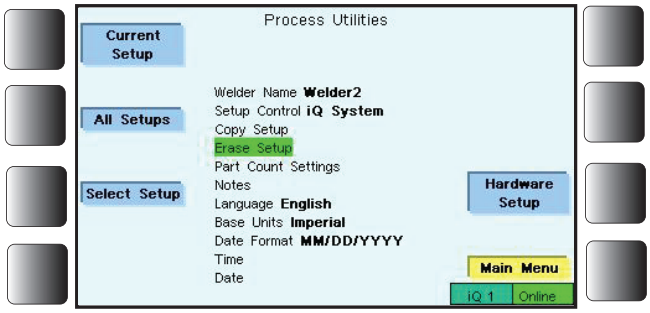


Figure 5–32 Erase Setup

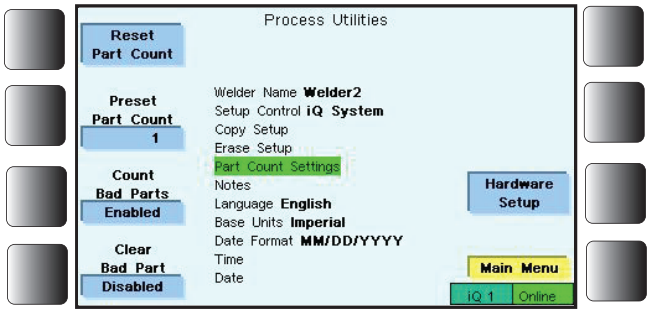


Figure 5–33 Part Count Settings

Process Utilities, Continued from Previous Page

Notes

It is important to document information about your process. With the dozen components or fields that make up Notes for one setup, a customized record can be invaluable. See Figure 5-34 below.

This utility makes it easy to name, or identify each of the fields using the virtual keyboard.

The Erase Name option also makes it easy to quickly remove a name.

Notes become part of the setup, so a major benefit is that future setup time will be much shorter when trying to create the same or similar setup.

Program Notes

EXAMPLE: Why use Notes?

With a manual press, pressure values for P1 and P2 are not part of the Setup file itself.

However, to record those values using the Notes feature will allow for those pressures to be recalled.

Use the Manual P1 and Manual P2/Hold fields to record the information.

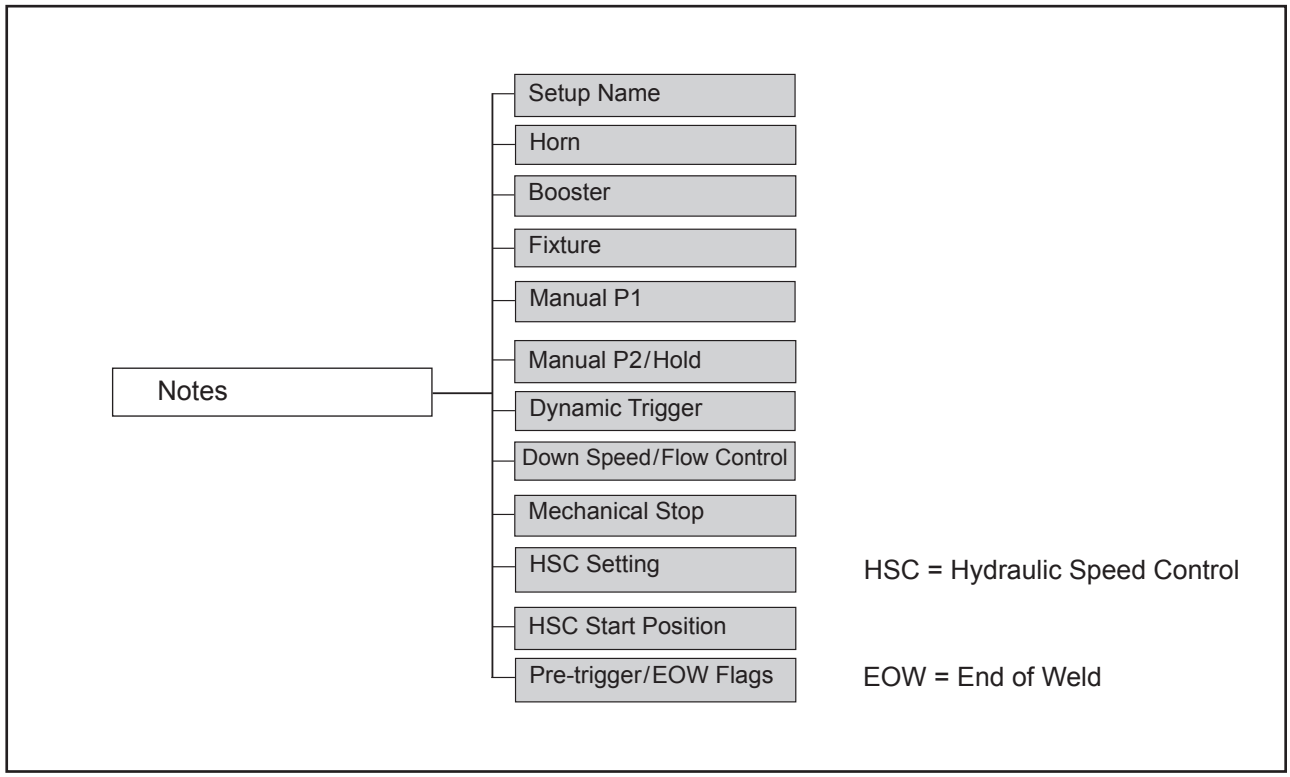


Figure 5–34 Notes

Process Utilities, Continued

Process Utilities, Continued from Previous Page

Hardware Setup

Hardware Setup and its submenus can be used before start-up, or during normal operation.

Typically Process Utilities have been set before Hardware Setup is completed.

Time, Date, Base Units, Setup Control, and the other utilities have usually already been established before Hardware Setup is programmed.

Serial Port

The first group of hardware settings deals with the serial port on the generator. These selections configure the ***iQ*** generator's port to transfer cycle data to a separate computer. See Figure 5-35.

Output Format

Use the Output Format function to choose one of three keyboard characters as the delimiter:

Comma - Tab - Semicolon

Most database and spreadsheet programs are able to read or save data in a delimited format. See Page 120 for more detailed information about the serial data format.

LF after CR

Each line of output ends with a *carriage return* (CR). Some devices automatically insert a *line feed* (LF) to advance the paper, while others do not. Enabling the LF After CR function makes it possible to insert a line feed at the end of an output string.

Output Mode

Use Output Mode to determine the type of data that will appear in the part record. Selections are defined below:

All - All parts are sent to the output device immediately after the weld cycle.

None - No parts are sent to the output device.

Good - Only good parts are sent to the output device.

Bad - Only bad parts are sent to the output device.

Suspect - Only suspect parts are sent to the output device.

Bad and Suspect - All bad and suspect parts are sent to the output device.

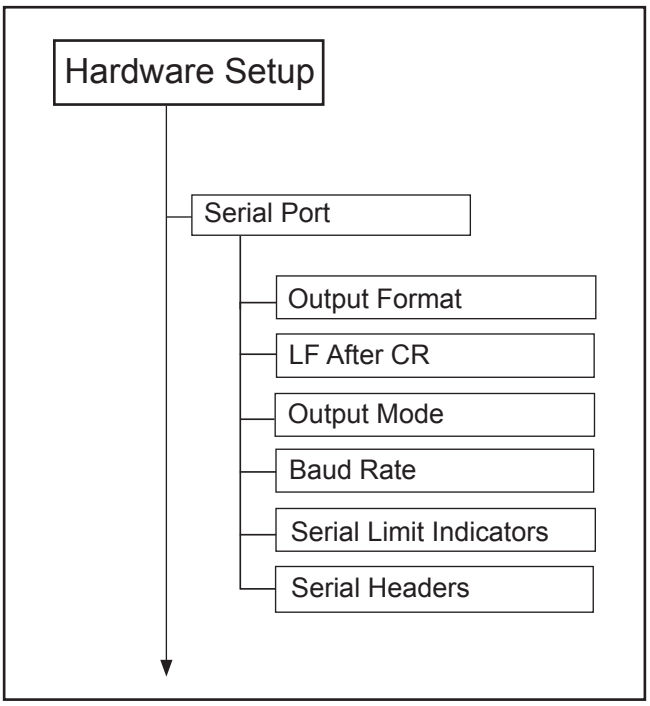


Figure 5–35 Serial Port Selections

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Baud Rate

Baud rate is the serial port output speed in bits per second.

Choose a baud rate appropriate for your output device.

Serial Limit Indicators

Limit indicators are characters that appear in front of displayed or printed part data indicating whether the data has reached or exceeded an upper or lower limit.

The *greater than* sign (>) means that an upper limit Suspect value has been exceeded.

Two *greater than* signs (>>) mean that an upper limit Bad value has been exceeded.

The *less than* sign (<) means that a lower limit Suspect value has not been reached.

Two *less than* signs (<<) mean that a lower limit Bad value has been exceeded.

Select Disable if the limit indicator might confuse a program that is running an SPC or data collection application.

Select Enable to allow use of the limit indicators.

Serial Headers

At the end of every cycle, the cycle data also gets sent out via the serial port.

The user can send (print) this data, each time the Print soft key is pressed.

NOTE

Baud rate settings on both the sending unit (iQ generator) and the receiving unit (computer) must be the same for communication between the devices to work properly.

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

System Status I/O

The next group of hardware settings (following the Serial Port settings) deals with the generator's System Status I/O. These six selections enable customization of some of the ***iQ*** generator's input and output signals. Figure 5-36 shows these functions.

Auto Start Input

Use the Auto Start Input function to choose one of two types of input that can originate the Auto Start signal:

Solid State, or

Mechanical

Choosing Mechanical presents another choice. That is Switch Debounce Time - choose 5ms, 10ms or 25ms. Switch debounce time is typically used when using a relay to activate the Auto Start input.

Auto Stop Input Enabled

This function can be disabled or enabled. The default setting is Enabled and set to End of Cycle.

When the Auto Stop Input is enabled, the operator selects either End of Weld, or End of Cycle.

• End of Weld - When Auto Stop is set to End of Weld, the auto stop input signal terminates the weld but not the complete weld cycle. If hold is enabled, it begins at the trigger of this signal.

• End of Cycle - When Auto Stop is set to End of Cycle, the auto stop input signal terminates the complete weld cycle (hold is not executed, even if enabled).

Programmable Status Output 1 (J3 pin 4)

J3 represents the generator's output connector, and Pin 4 is programmable.
It can be programmed to provide:

E-Stop Status or Overtemp Status.

The default setting is E-Stop.

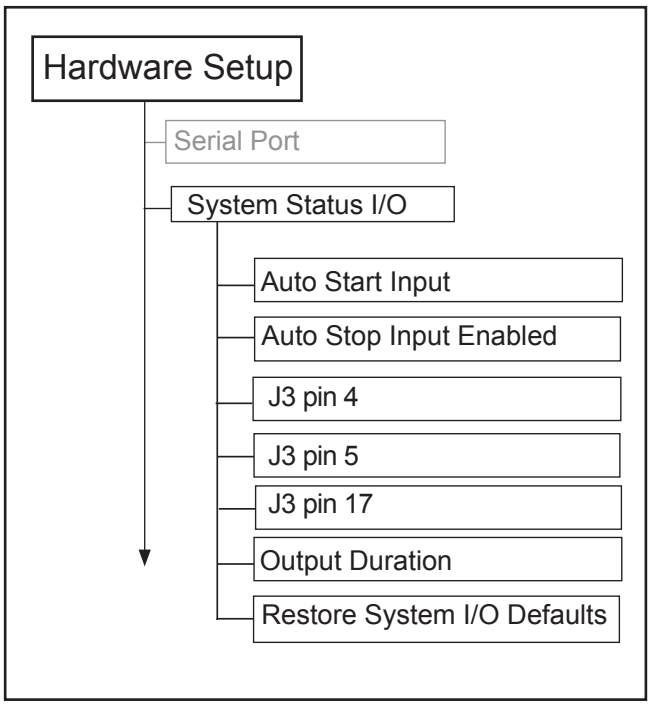


Figure 5–36 System Status I/O Selections

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Programmable Status Output 2 (J3 pin 5)

J3 represents the generator's output connector, and Pin 5 is programmable.
It can be programmed to provide:
Hold Status, In-Cycle Status, or In-Cycle no After-burst

The default setting is Hold Status.

Output Duration

This is the duration of the Good, Suspect, or Bad part output signal. Use the Output Duration function to select the length of the output signal:

Maintained or 100ms Pulse

The default setting is Maintained.

Restore System I/O Defaults

Choose this function to restore the original system input/output defaults.

Once Restore is chosen, a secondary screen is displayed asking the operator to verify the choice:

Are you sure you want to Restore I/O Defaults?

See Figure 5-37 for the screen view.

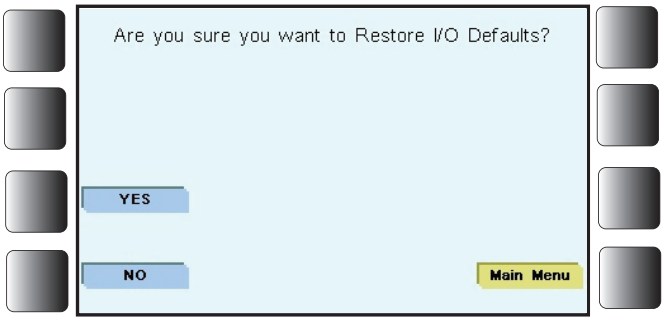


Figure 5–37 Restore System I/O Defaults

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Additional Hardware Settings

The next group of hardware settings (following the Serial Port settings and the System Status I/O settings) deals with a variety of functions. These six selections provide further customization of the ***iQ*** generator. Figure 5-38 diagrams these selections.

Advanced Process Settings

Enabling Advanced Process Settings allows for adjustment of several advanced process settings within the Process Setup menu. Brief descriptions of these settings are given below.

- Free Run Frequency and Scan Stack,
- Frequency Tracking,
- Frequency Lock and Hold,
- System Frequency Limits,
- Ramp Up, and
- Ramp Down.

• Free Run Frequency - Free run is the frequency at which the generator drives the ultrasound output pulses until the actual operating frequency is detected. Typically this value should be 50-100 Hz below the operating frequency of the stack.

• Scan Stack - With Advanced Process Settings enabled:

Run the scan: Return to the Main Menu. Select the Process Setup soft key to display the Process Setup screen. Scroll to Adv. Process Settings in the list and select the Adv. Process Settings soft key. Scroll to Free Run Frequency in the displayed list and select the Scan Stack soft key. Follow the displayed instructions.

For more detail on the Scan Stack feature please refer to our website to download ***Application Note 512*** at ***http://www.dukane.com/us/DL_ApplData.asp***

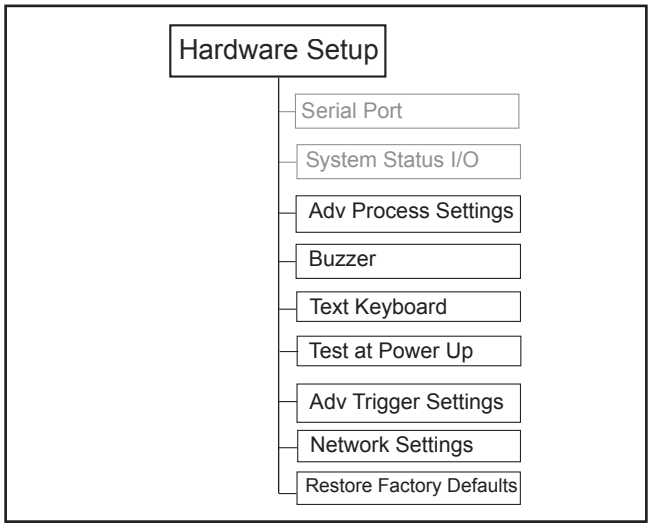


Figure 5–38 Additional Hardware Settings Diagram

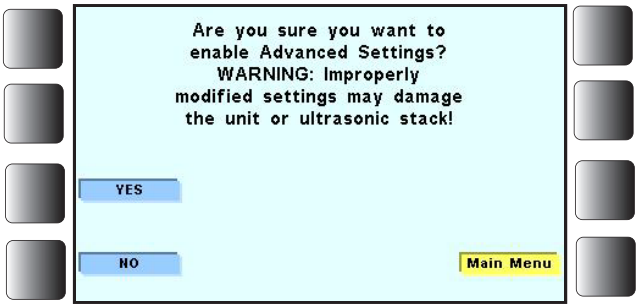

Are you sure you want to enable Advanced Settings? WARNING: Improperly modified settings may damage the unit or ultrasonic stack!
YES
NO
Main Menu

Figure 5–39 Advanced Process Settings Warning

CAUTION

Before adjustments to advanced process settings are allowed, an intermediate screen with a warning appears. See Figure 5-39. This warning reminds the operator that modifying settings may damage the generator, or the ultrasonic stack.

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

• Frequency Tracking - When Enabled, at the end of each cycle the operating frequency is applied to the Free Running Frequency setting. It's based on a 16 point average. Therefore, after 16 cycles, the actual operating frequency will be the Free Running Frequency setting. If the generator has not been cycled for a minimum of 5 minutes, the generator will request that the stack be scanned in order to verify the optimum Free Running Frequency setting.

For more information about Frequency Tracking, refer to our ***Application Note 513*** on the Dukane website at: ***http://www.dukane.com/us/DL_ApplData.asp***

• Frequency Lock/Hold - When frequency lock and hold is disabled, the frequency of the stack is tracked by changing the frequency of the ultrasound driving pulses to match the actual operating frequency.

When enabled the frequency of the stack is tracked until lock is achieved. Then it is ignored and the ultrasound output remains at a fixed frequency until the end of the weld.

For more information about Frequency Lock/Hold, refer to our ***Application Note 505*** on the Dukane website at: ***http://www.dukane.com/us/DL_ApplData.asp***

• System Frequency Limits -

Wide - In wide mode the upper and lower frequency limits are set to the maximum and minimum allowed frequencies for the generator. These values are dependent on the system frequency of the generator.

Normal - In Normal mode the upper and lower frequency limits equal the free run frequency ± 500Hz.

Narrow - In Narrow mode the upper and lower frequency limits equal the free run frequency ± 200Hz.

Manual - In Manual mode the user sets the upper and lower frequency limits. To be valid, the settings must be within the maximum and minimum values for the generator and at least 25Hz greater than the "upper" free run frequency and 25Hz less than "lower" free run frequency.

NOTE

Why System Frequency Limits Modes Might be Chosen

Wide - This mode is primarily used for testing "bare" transducers (no booster or horn attached).
Normal - This mode is the one most often used covering a wide variety of horns.
Narrow - This mode is used when the acoustic stack has known unwanted frequencies that are close to the main operating frequency.
Manual - This mode allows for a frequency range to include only frequencies that are wanted, and excluding unwanted frequencies.

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

• Ramp Up Time - Although the Ramp Up time is factory set, it is variable and can be adjusted to account for starting characteristics of a particular stack.

The Ramp Up setting depends on the generator load at the start of a cycle.

The Ramp Up time increases the amplitude *linearly*, in the programmed time period at the start of the weld, from zero to the programmed amplitude level. The stack is brought up to the operating amplitude smoothly, without shock stress.

• Ramp Down Time - Although the Ramp Down time is factory set, it is variable and can be adjusted to account for characteristics of a particular stack.

Ramp Down Time decreases the amplitude linearly to zero in the programmed time period following the end of the weld, when ultrasound is shutting off.
The stack is brought down from its weld amplitude, reducing shock stress.

• Restore Advance Process Defaults - Enable this feature by pressing the Restore Defaults soft key.
A screen appears with the question,

Are you sure you want to Restore Advance Process Defaults?

Select YES to restore all of the advanced process settings to their factory defaults.

NOTE

Ramp Down Time

Ramp Down Time extends the service life of complex acoustic stacks by minimizing stresses encountered during the process of shutting off the ultrasound. It is especially recommended for very large horns, or when the ultrasound is shut off in air.

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Buzzer

Use the Buzzer function to turn the internal generator buzzer on or off.

Disabled - The buzzer will not sound.

Enabled - The buzzer can signal two different events. See Figure 5-40 to the right.

- Buzzer Top of Stroke - When enabled, buzzer sounds when top of stroke is reached.
- Buzzer at Trigger - When enabled, buzzer sounds when the trigger point is reached.
- Parts Alert: The buzzer, when enabled, beeps once when a suspect part is detected, and it beeps twice when a bad part is detected.

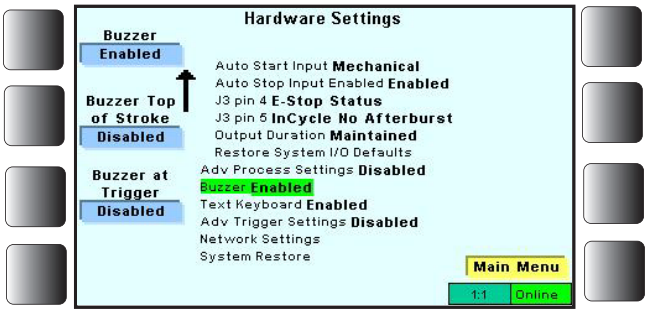


Figure 5–40 Buzzer Enabled

Text Keyboard

The virtual keyboard is enabled by default, and it pops up when required. When disabled, the virtual keyboard will not appear.

Test at Power Up

Each time the generator is powered On, the operator will be prompted to execute a TEST of the ultrasonics stack. The TEST can also be cancelled. The feature can be disabled from the Hardware Settings screen. Test at Power Up is Enabled by default.
See Figure 5-41.
The “Test at Power Up” feature can also be cancelled by activating the “System Latch Reset” input (J2-12).

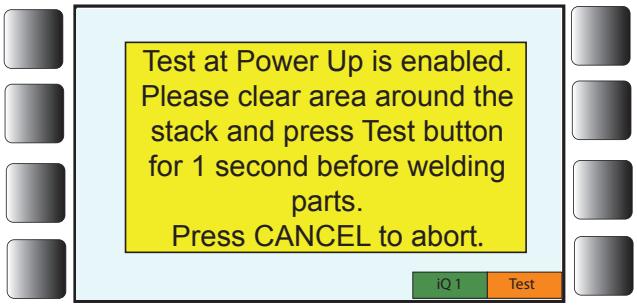

Test at Power Up is enabled.
Please clear area around the stack and press Test button for 1 second before welding parts.
Press CANCEL to abort.
iQ 1
Test

Figure 5–41 Test at Power Up

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Advanced Trigger Settings

When Advanced Trigger Settings are enabled, basic trigger settings are enhanced.

For example, in the Process Setup menu, when Force is the Trigger Type, Sensing Start Position is added to refine the Force selection. See the figure below where basic and advanced trigger functions are illustrated.

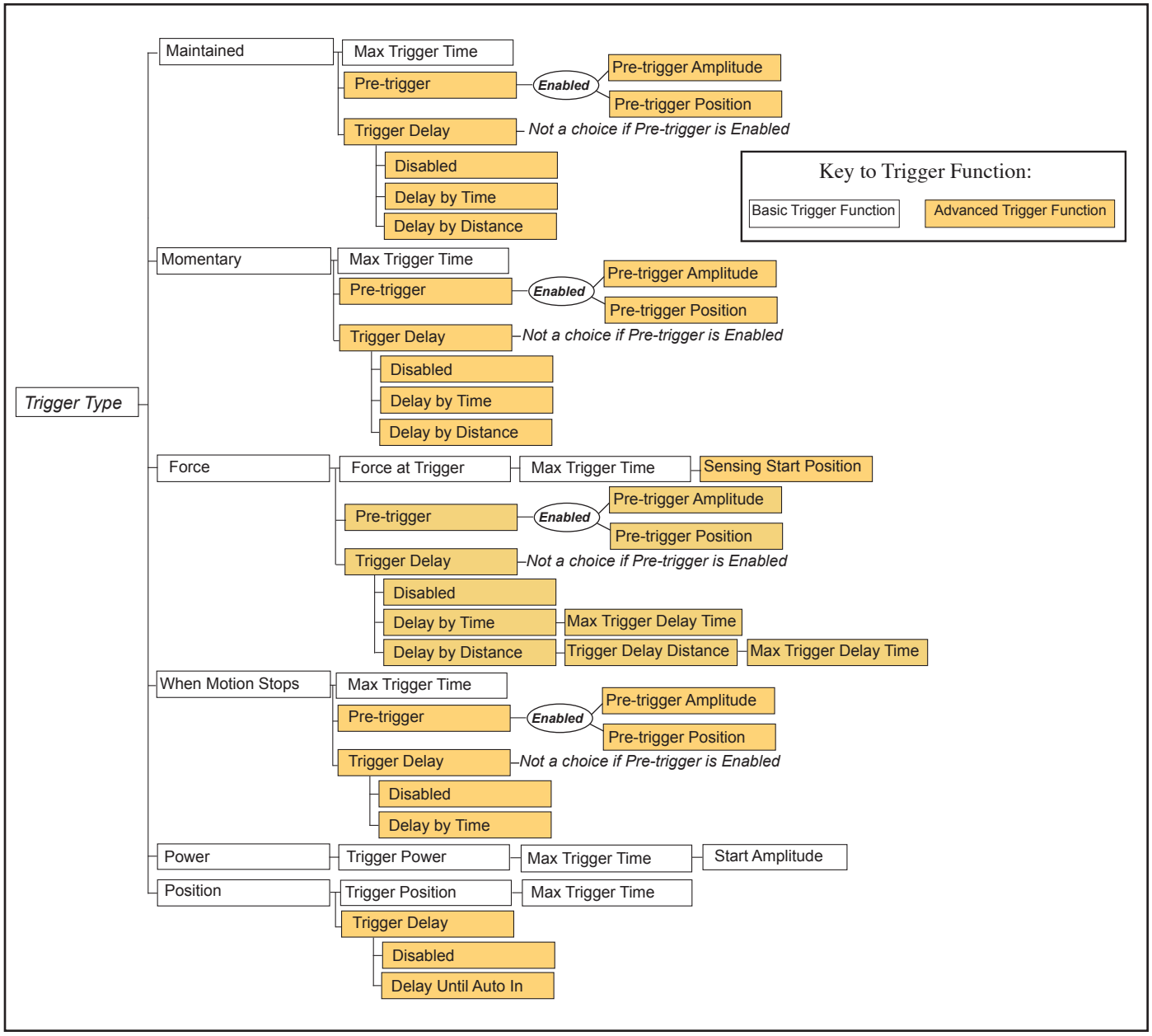


Figure 5–42 Trigger Function - Basic and Advanced

Hardware Setup, Continued

Hardware Setup, Continued from Previous Page

Network Settings

The Network Settings screen as seen in Figure 5-43 has five elements:

DHCP - These initials stand for Dynamic Host Configuration Protocol. The protocol was established for assigning dynamic IP addresses to devices on a network.

DHCP should be enabled if connecting multiple generators when using an Ethernet router or switch.

DHCP can be enabled or disabled depending on customer requirements.

IP Address - This **I**nternet **P**rotocol address is a number unique to a piece of equipment acting as an identifier when the equipment is connected to a network. An IP address is specified when a static IP is required.

Network Mask - Automatically assigned by the DHCP server.

Gateway Address - Automatically assigned by the DHCP server.

Network Link - This shows the status of the connection to a network:

Linked - This displays the speed of the network connection.

Not Linked - Down

Restore Factory Defaults

Choose Restore Factory Defaults when restoring the generator software to the factory default settings.

Before this is allowed, however, an intermediate screen questioning the action appears. See Figure 5-44.

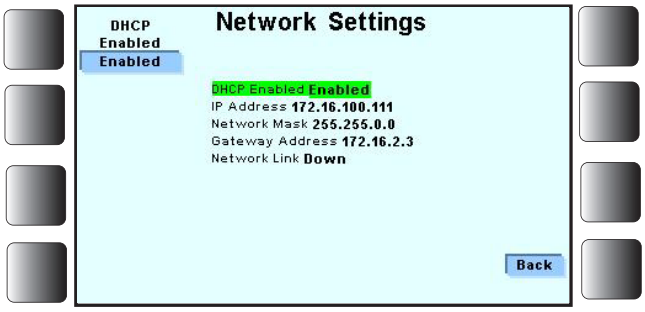


Figure 5–43 Network Settings

NOTE

If the user is directly connecting to a laptop or PC, the PC's IP address should be set to 169.254.0.x (x must be 2-255).
The (x_ in the computer's IP address can not be the same x as in the generator's IP address.

NOTE

Network Settings are maintained even after a Restore Factory Defaults.

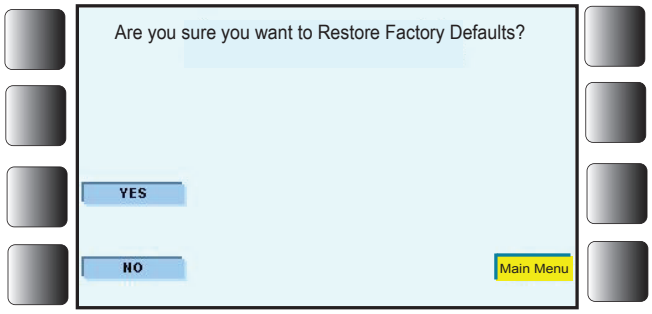


Figure 5–44 Restore Factory Defaults?

NOTE

Performing a **Restore Factory Defaults** can not be reversed.

Operate Screen

The Operate screen displays weld cycle data in real time.

Figure 5-45 shows the main Operate screen.

Process characteristics listed below the setup name are the ones chosen (as process limits) to be displayed or programmed.

Part # in the upper left corner of the Operate screen records the running total of processed parts.

When a minimum of 10 parts have been processed, press the soft key next to the total number of parts box. The next screen Search Part History appears, and allows searches by Part Number, Time, Date, Previous Bad, Previous Suspect, and Previous Alarm.

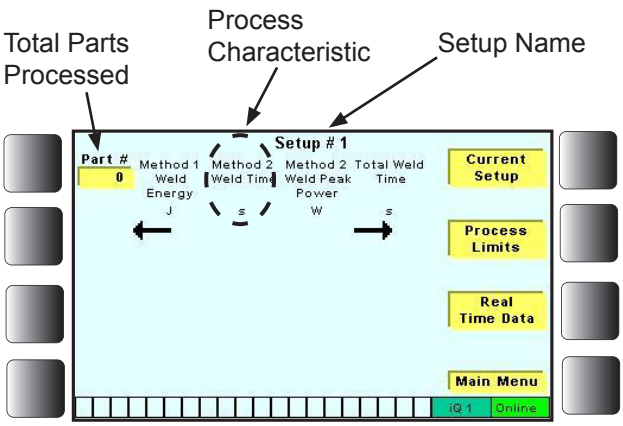


Figure 5–45 Main Operate Screen

Part Number History

Search by Part # - Press this soft key to search for a specific part number in the cycle data.

Pressing the Part # soft key displays a search screen after a minimum of 10 parts are in the cycle data.

Search by Time - Press this soft key to search for a part know to have been welded at a specific time in the cycle data.

Search by Date - Press this soft key to search for a specific part welded on a specific date in the cycle data.

Previous Bad - Press this soft key to search for a previously welded bad part in the cycle data. Pressing the soft key again will continue searching for the next previously welded bad part.

Previous Suspect - Press this soft key to search for a previously welded suspect part in the cycle data. Pressing the soft key again will continue searching for the next previously welded suspect part.

Previous Alarm - Press this soft key to search for a previously part that had an alarm in the cycle data. Pressing the soft key again will continue searching for the next previous part that had an alarm.

Direction - Press this soft key to change the direction of the search from previous cycle data parts to next cycle data parts.

Current Setup

While viewing the Operate screen, (or from the Main Menu), press the soft key next to Current Setup, and a view similar to the one shown in Figure 5-46 will appear.

This is usually a multiple page (display) list of the main parameters that were set for the current setup.

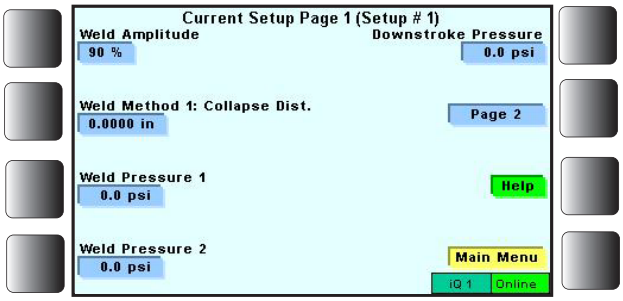


Figure 5–46 Current Setup

Process Limits

Press the soft key next to Process Limits, and the process limits list, similar to the one shown in Figure 5-47 is displayed. Adjustments to the list of process characteristics can be made easily.

Press Back when finished making adjustments to the list of process characteristics, and once again the main Operate screen will be shown.

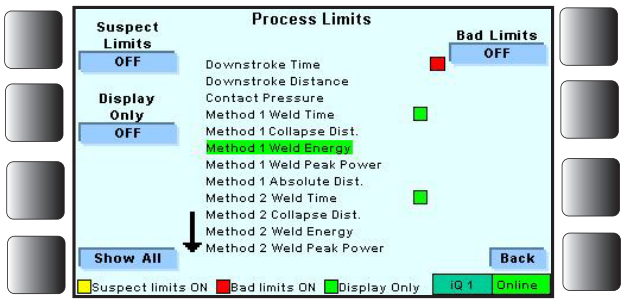


Figure 5–47 A Process Limits List

Real Time Data

See Figure 5-48.

Press the soft key next to Real Time Data, and the display changes to show press characteristics for the current setup and weld cycle.

The possible characteristics are: Pressure, Force, Distance, Power, and Frequency.

Characteristics displayed depend on system configuration.

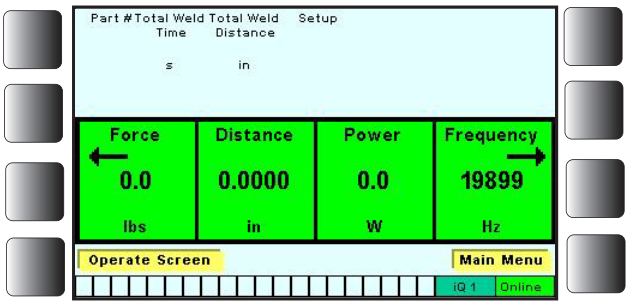


Figure 5–48 Real Time Data

Graph

The generator is factory programmed to provide graphs with amplitude and power as the vertical axes.
Figure 5-49 shows the graph screen.

Graph Setup

Figure 5-50 shows the graph setup screen used when selecting parameters for the two ***vertical*** axes of the graph. (The horizontal axis represents time.)

Select from these parameters:

Amplitude, Power, Frequency, Energy, Distance, Speed, Pressure, Force

1. **Red Axis** - Press one active soft key representing the parameter for the vertical (red) axis. This axis is on the left side of the graph.

2. **Blue Axis** - Press one active soft key representing the parameter for the vertical (blue) axis. This axis is on the right side of the graph.

Figure 5-51 shows the graph setup screen used to choose a starting point for the graph.

3. Choose one of the active soft keys representing the event that starts the graphing procedure.

The events are:

Cycle Start, Trigger, or Weld Start.

Figure 5-52 shows the graph setup screen used to select the end point for the graph.

4. Choose one of the active soft keys representing one of two events that after they have finished, the graphing procedure will come to an end. The events are:

Weld End, Hold End

NOTE

As the graph is being designed with these setup screens, press ENTER to display the graph.

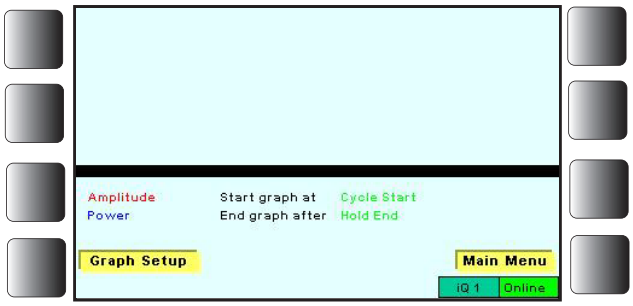


Figure 5–49 Graph Screen

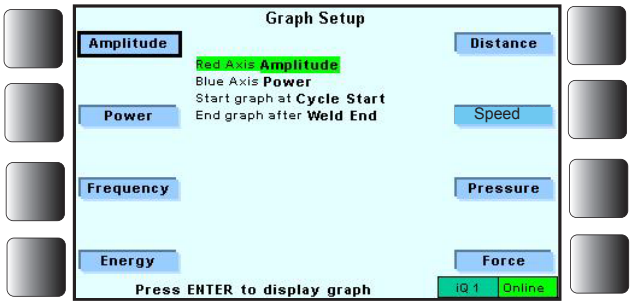


Figure 5–50 Graph Axis Setup Screen

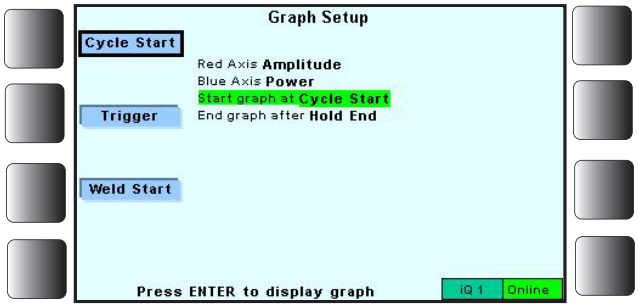


Figure 5–51 Start Graph at Setup

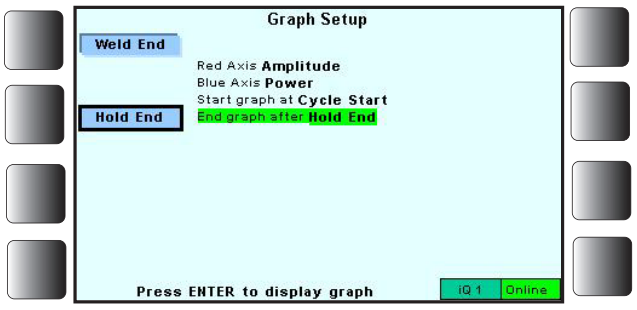


Figure 5–52 End Graph at Setup

Continued

Graph, Continued from Previous Page

Completed Graph

The figure below shows a completed graph.
This particular image resulted after pressing the TEST key.
See Figure 5-53 below.

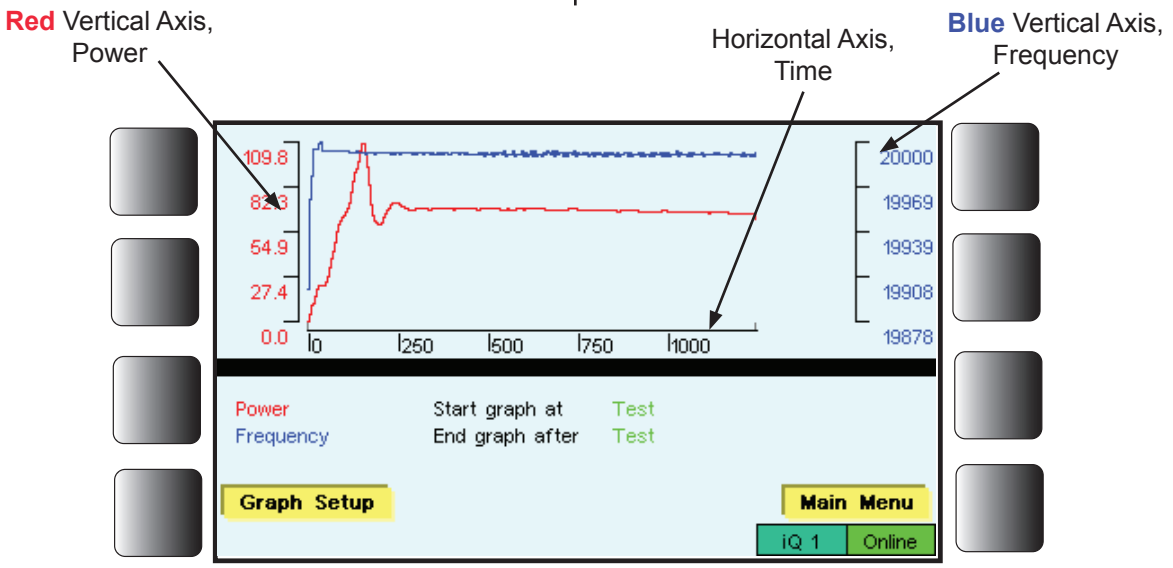


Figure 5–53 Example Graph Following Test

Help

From the main screen, (Figure 5-54 to the right) press the soft key next to Help.

This will produce a screen that gives information about your generator, including model and serial numbers.

An example of this screen is seen in Figure 5-55.

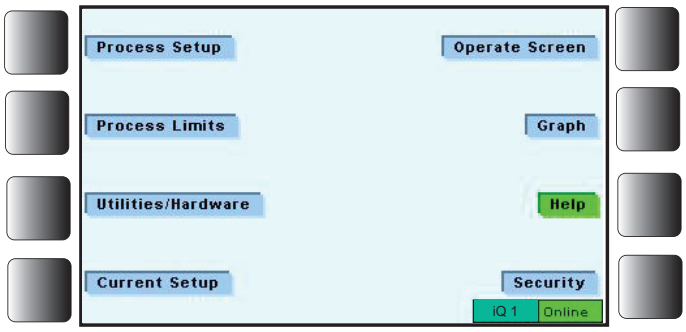


Figure 5–54 Locating Help on the Main Menu

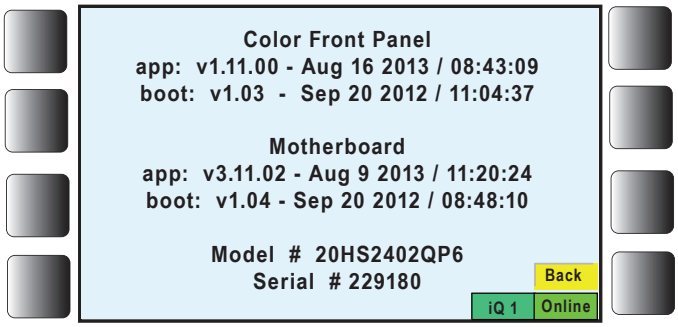

Color Front Panel
app: v1.11.00 - Aug 16 2013 / 08:43:09
boot: v1.03 - Sep 20 2012 / 11:04:37
Motherboard
app: v3.11.02 - Aug 9 2013 / 11:20:24
boot: v1.04 - Sep 20 2012 / 08:48:10
Model # 20HS2402QP6
Serial # 229180
Back
iQ 1
Online

Figure 5–55 Help Screen Example

Security

The Security menu choices control access to the programming menus by using individual logins for three levels: Administrator, Process Engineer, and Setup.

The table below shows what access each security level has. In addition the Operator column shows the access a generator operator would have when the three levels of control are in use.

NOTE

Operator - Usually the operator does not need to use the Security feature. Typically an operator only monitors the weld cycle using the Operate and Graph screens.

Main Menu Item	Persons needing an individual login.			Operator
	Administrator	Process Engineer	Setup	
Graph Screen	O	O	O	O
Operate Screen	O	O	O	O
Process Setup	O	O	X	X
Process Limits	O	O	X	X
Process Utilities	O	O	O ••	X
Hardware Setup	O	X	X	X
Current Setup	O	O	O	X
	O = Access		X= No Access	
•• = *Select Setup* is available.				

Table 5-I Security Access to Main Menu Item

Remote User Timeout

The purpose of this option of the Security menu is to yield (allow) or deny access to the programming features of the ***iQ*** generator under certain conditions.

This feature is most useful when a remote user (using ***iQ Explorer II*** software) and a user at the generator might both want to control the generator. A request for control (by either user) shows on the generator display and on the remote computer display.

If no response is given (by either user) to this request within 30 seconds, then in whatever state the generator had been left (Deny Control or Yield Control) before the request for control, that is the state in which the generator will continue to operate.

Example*: A remote user requests control of the generator, and no one is at the generator to respond to the request. If the generator had been programmed to yield control, then after 30 seconds, the remote user would have control.*

Access (to program the generator), is assigned to the Administrator as a default setting if no passwords have been set.

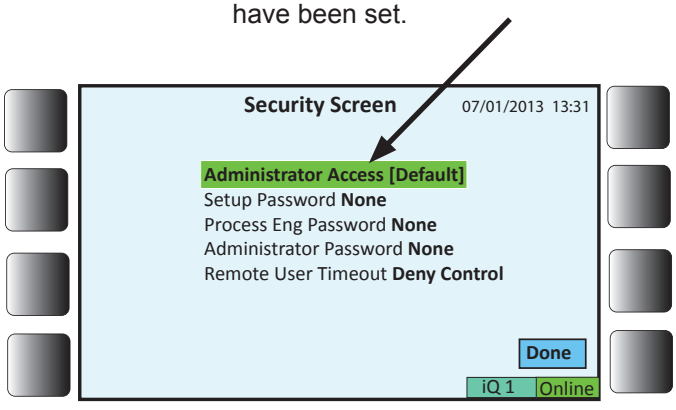


Figure 5-56 Security Screen - No Passwords Set

Continued

Using Security

Enabling Passwords for the First Time

1. Press the Security soft key. The Security Screen appears as shown in Figure 5-57. The word None means no passwords have been enabled or set.

In the example that follows, three passwords will be set: First, for the Administrator, then for the Process Engineer, and finally, for the Setup password.

2. Select, Administrator Password None in the list. (The selected phrase is highlighted in green.)

The soft keys Administrator Password, and Done are now displayed. See Figure 5-57.

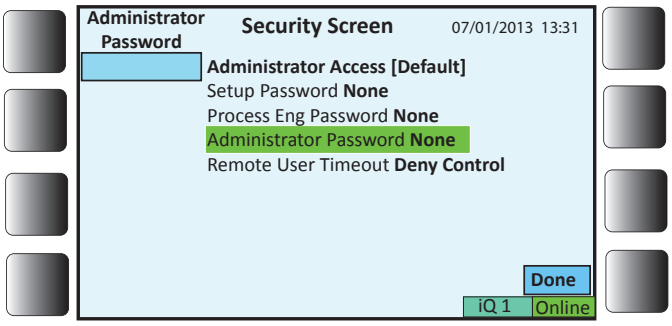


Figure 5-57 Security Screen - Administrator Password Selected

3. Press the Administrator Password soft key, and the alphanumeric virtual keyboard is displayed. This is shown in Figure 5-58.

Enter a password of up to 15 characters.

Press Apply Changes when finished.

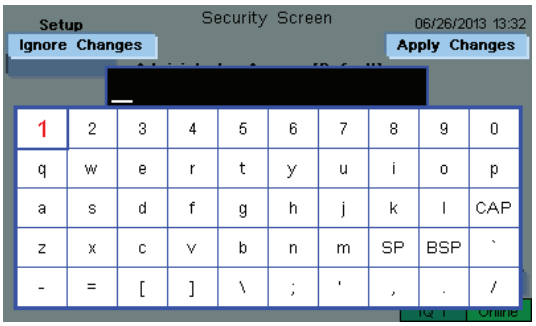

Setup
Security Screen
06/26/2013 13:32
Ignore Changes
Apply Changes
1 2 3 4 5 6 7 8 9 0
q w e r t y u i o p
a s d f g h j k l CAP
z x c v b n m SP BSP
- = [ ] \ ; ' , . /

Figure 5-58 Virtual Keyboard

The next screen to appear looks like Figure 5-59.

Because the screen message says, Security Enabled: Currently Logged Out, the Administrator must enter the Login Password to activate access to security features.

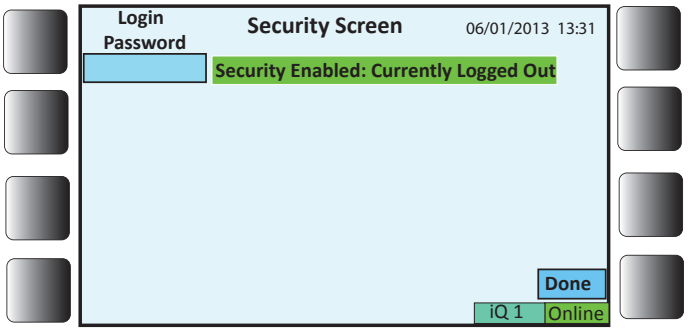


Figure 5-59 Security Screen - Currently Logged Out

Once the Administrator password has been entered, the screen appears as shown in Figure 5-60.

Note the change in the Security Screen from what is seen in Figure 5-58. The Administrator Password has been Enabled. Also Administrator Access is followed by [Admin] showing that the Administrator has current security access.

Login is complete for the Administrator.

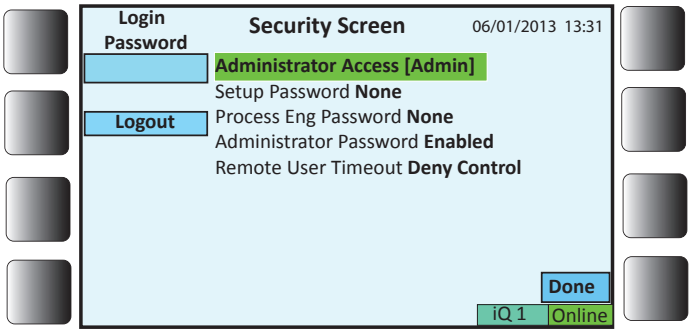


Figure 5-60 Security Screen - Administrator Access Enabled

Continued

Security, Continued from Previous Page

At this point the Administrator typically has four options:

• **Logout** - Press the soft key next to Logout, and the Administrator will be logged out. None of the security levels will be active.

• **Done** - Press the soft key next to Done to exit and return to the main menu.

• **Erase** - Select Administrator Password Enabled in the list. Press the Erase soft key, and the password will be erased **or**,

• Continue enabling passwords.

For additional passwords, complete Steps 4 and 5.

Also, please read the NOTE to the right. →

NOTE

If the Login Password soft key is pressed, and a wrong password is entered, a screen prompt indicates an incorrect password has been entered. The next screen shows that the person has been logged out. Restart the login process to activate the security features.

4. After enabling the Administrator password, the next level to activate is usually Process Engineer.

Select, Process Eng Password None in the list.

Next, Select Process Eng Password with the upper left soft key, and the alphanumeric virtual keyboard is displayed. Enter a password of up to 15 characters.

Press Done when finished.

5. After setting the Administrator password and the Process Engineer Password, select the line: Setup Password None. Set a password for Setup repeating the methods already explained.

Figure 5-61 shows the Security Screen when all three passwords have been enabled.

Press the Logout key.

Figure 5-62 shows that the Administrator has logged out.

Login Password and Done are choices.

Press the soft key next to Login Password to login.

Press Done to exit and return to the main menu.

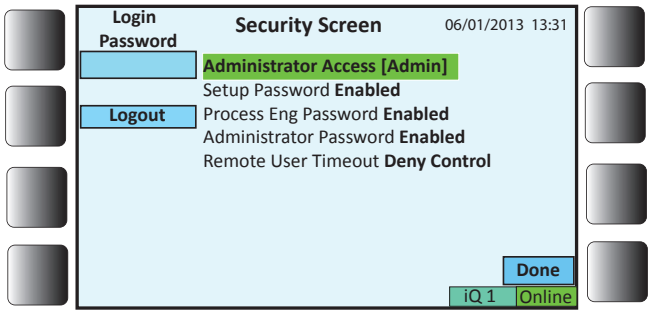


Figure 5-61 Security Screen - Passwords Enabled

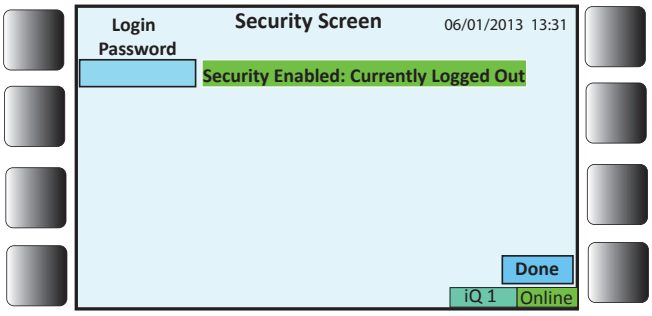


Figure 5-62 Security Screen - Logged Out

Continued

Security, Continued from Previous Page

After Passwords are Enabled

Once passwords have been enabled as described above, generator menu access is controlled.

For each person assigned a password, please use the four steps detailed below for the login/logout procedure.

1. Press the soft key for Security. The Security Screen appears as shown in Figure 5-63.

The previous user has logged out.

2. Any of the three passwords (Setup, Process Eng, or Admin) that were already enabled can be entered.

In this case, the Setup password will be entered, and the screen then will resemble what is shown in Figure 5-64.

The Security Screen indicates that Setup Eng controls access to the generator.

3. Press **Done** to continue working with the available menus.

Available menus for Setup Eng are: Select Setup, Operate Screen, Graph, Help, and Security.

4. When finished working with the generator, press Security to get to the Security Screen again. Then press the soft key next to Logout to quit.

5. Finally, press Done so that the main menu screen is displayed when the session is complete.

NOTE

When using the Security feature, only one person can be logged in at a time. Each login session must end with a logout.

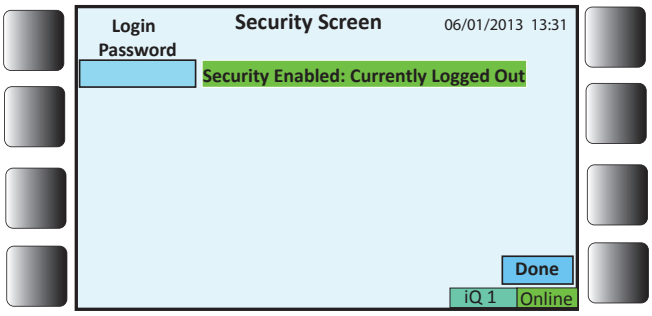


Figure 5-63 Security Screen - Logged Out

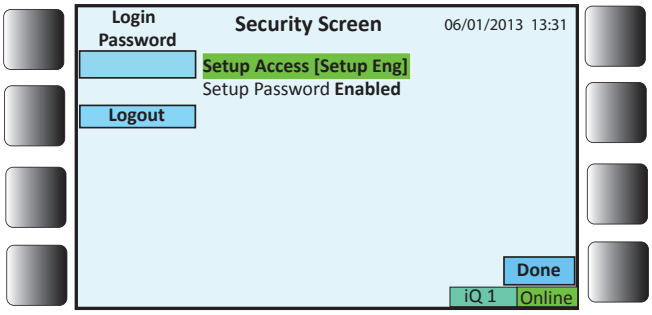


Figure 5-64 Security Screen - Setup is Logged In

NOTE

Refer to Table 5-I for a guide to the levels of access that are possible when using the Security function.

Continued

Security, Continued from Previous Page

Other Security Prompts

With login passwords in use, the levels of access to the generator are established.

Security prompts - like the samples seen in Figures 5-65 and 5-66 to the right - are displayed when access to menu features has been limited.

Forgotten Password?

Contact Dukane if the password has been forgotten.

See ***Section 10 - Contacting Dukane***.

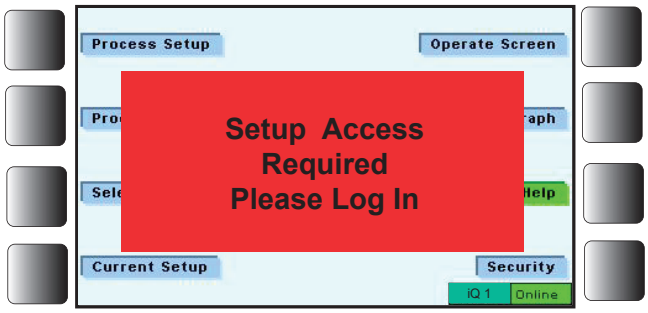


Figure 5-65 Security Prompt for Process Engineer Access

Figure 5-66 Security Prompt for Setup Access

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SECTION 6

System Operational Testing

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Operational Test of the Acoustic Stack 96
Cycling the System. 98

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Overview

An ***iQ Series*** generator must be operating and connected to the press/thruster in order to test the system.

For efficient operation of a Dukane ultrasonic assembly system, the ultrasound signal from the generator must match the frequency (vibrational characteristics) of the stack that is being driven. Each stack has unique vibrational characteristics dependent on the combination of stack components. In addition, the characteristics of a particular stack may vary slightly during operation because of temperature and loading factors.

To match the generator output signal with the characteristics of a particular stack, the generator output frequency is adjusted by Dukane's patented phase-locked-loop Digi-Trac pulse-width modulation circuitry.

The Digi-Trac feature automatically adjusts the ultrasound signal to match the vibrational characteristics of the stack being driven. When the ultrasound turns on during each operating sequence, the Digi-Trac circuit monitors the motion of the stack on a frequency cycle-by-cycle basis and adjusts the ultrasound signal for the optimum setting. Because the Digi-Trac continuously monitors each operating sequence, it compensates for vibrational changes that occur during repeated operations due to heating of the stack components. It also compensates for changes that occur over longer time periods due to aging of the piezoelectric crystals in the transducer, or possible wear of the ultrasonic horn.

The Digi-Trac feature excels in environments hostile to reliable operation, such as high duty cycles or high stress, and continuous-duty applications. In such situations, the Digi-Trac circuit compensates for the unique vibrational characteristics of each stack due to differences caused by aging, loading, temperature changes, and differences in horn configurations.

Operational Test of the Acoustic Stack

The following test procedure is suggested before starting the generator, to verify that the vibrational characteristics of the stack fall within the range of the Digi-Trac. All Dukane stack components are manufactured to tolerance specifications within this range. A non-Dukane horn, an improperly assembled stack, or a stack component that is worn or damaged, can result in vibrational characteristics outside these specifications, and will require some adjustment. This test reveals the existence of any problems and directs you to corrective action.

1. Check the following:
   a. Make sure that the correct booster and horn for the application are installed in the thruster.
   b. Check the ***iQ Series*** system components for proper grounding.
   c. Check the ultrasound cable connections on the generator and thruster for proper seating and security.
   d. Verify that the horn is not under load (not in contact with a fixture or part).
2. Push the generator REAR panel AC breaker switch to ON. Then the FRONT panel power indicator will flash on start-up, and finally turn a steady GREEN. This indicates that the system is operational.

   If the power indicator stops flashing, but remains RED, do not go any further, there is a problem with an internal power supply.
3. Press the TEST key (in ONLINE mode only). See Figure 6-1.
   a. System Power Output:
      - If the power output display remains less than the typical 200 Watts and the horn frequency is within the standard frequency range, the stack should be operational.
      - If the power output exceeds 200 Watts, there may be a problem with the stack.

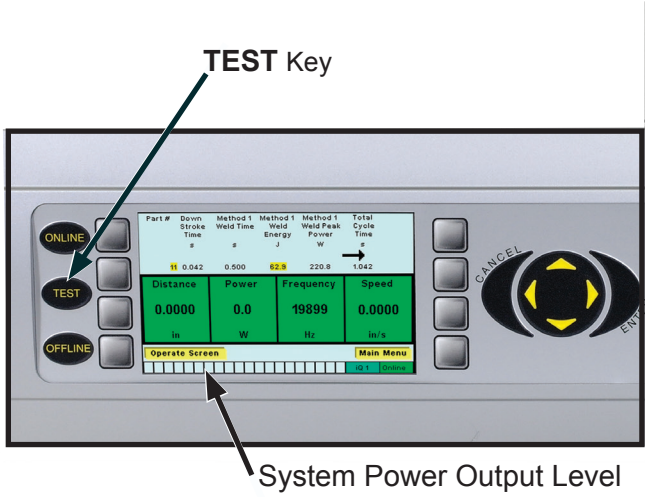

Figure 6-1 ***iQ*** Generator TEST Key

Continued

Continued from Previous Page

- Press the TEST key. As long as this key is pressed, test data, as shown in Figure 6-2 appears.
- Press the GRAPH soft key to display the graph screen.
- A display like the one shown in Figure 6-3 to the right will appear as a graph resulting from the test sequence.

b. If an overload alarm is displayed, a mismatch has occurred between the generator's ultrasonic output signal and the stack.

Refer to the next section, ***Set-up Guidelines and Troubleshooting***, and see the Alarm Message table.

4. If all the indicators pass their tests, the stack is within the Digi-Trac range.

   Typically ultrasonic acoustic stacks operate between 50-200 Watts depending on the gain of the booster/horn. The vibration amplitude of the horn and booster and the mass of the horn determine the amount of power needed to vibrate the stack.

   - If the system passes the tests of these four steps, proceed to *Cycling the System*, on the next page.
   - If one or more of these tests have failed, go to the next step.

5. Turn the generator OFF. Check the stack for proper assembly, damaged components, or dirty mating surfaces. Recheck the ultrasound cable for proper connections. Repeat Steps 1 through 4. If the test still fails, go to the next step.

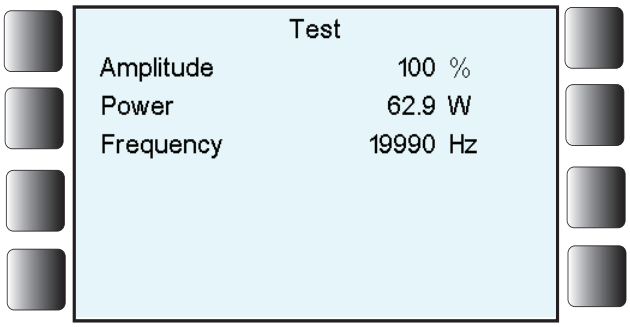

Figure 6-2 TEST, Screen Display

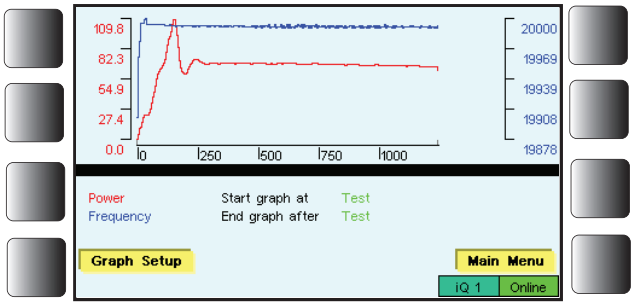

Figure 6-3 TEST, Graph Display

NOTE

Note the Frequency and Power values in the graph above.
If using ***iQ Explorer II*** software to control the process, you have the option of saving the test data for future reference.

Continued

Continued from Previous Page

Acoustic Stack Test

6. Turn the generator OFF, remove the stack from the thruster, and remove the horn from the stack. Reinstall the transducer-booster assembly in the thruster and turn the generator ON. Repeat Steps 2 through 4.

   If the assembly passes with the horn removed, the horn is outside the specifications required for operation with the Digi-Trac preset range. Reassemble the horn to the stack.

   If any failure indications are present with the horn removed, check the booster and the transducer for the following

   - Any visible damage
   - Loose or cracked stud
   - Pitted or dirty mating surfaces

   Make any necessary repairs or adjustments.

   Go to Step 7.
7. Repeat Steps 1 through 6.
   - If the failure indications disappear, reassemble the horn to the stack and repeat Steps 2 through 4.
   - If any failure indications are still present, do not run this stack. Return the transducer and booster to Dukane for analysis.

Cycling the System

1. Check that you have correctly performed the following:
   a.) Installed the stack in the thruster and have closed the stack access cover securely.
   b.) Secured the fixture in place.
   c.) Performed the Operational Test of the Acoustic Stack as detailed on Page 96 of this section.
2. Verify that all controls on the Press/Thruster and the generator are set as required for this operation.
3. Place a part in the fixture.
4. Manually cycle the system.

   Activate both operate switches at the same time to start the system, and hold fingers in place until the ultrasound starts. Releasing the fingers before ultrasound starts will abort the cycle.

NOTE

For more information about stacks, see this article:

www.dukane.com/us/SE_stackarticle.htm

SECTION 7

Set-up Guidelines and Troubleshooting

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Default Settings - Process Setup 101
Changing Default Settings 101
Charts: Trigger Force, Weld Time, Weld Force 102
Air Cylinder Size and Force 105
Troubleshooting 106
The *iQ* Generator Won't Cycle 106
No Ultrasound 106
The Power-up Sequence Stops 107
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Set-up Guidelines

The ***iQ Series*** ES generator is shipped from the factory with a few default settings. See the table below for those values.

Default Settings - Process Setup (***iQ*** Series Generator ES Pneumatic)	
Item	**Setting**
Initiate Settings	
Initiate Mode	Manual
Latch on Bad Part	Disabled
Trigger Settings	
Trigger Type	Force
Trigger Force	0 lb
Max Trigger Time	0.000 s
Advanced Trigger Settings	Disabled
Weld Settings	
Weld Mode	Single Method
Downstroke	0.0 psi
Primary Method 1	Distance 0.0000 in
Max Weld Time 1	0.000 s
Secondary Method 1	Disabled
Weld Pressure 1	0.0 psi
Upstroke	0.0 psi
Weld Amplitude	100%
Hold Settings	
Hold Method	Time 0.000 s
Hold Pressure	0.0 psi
Afterburst Settings	
Afterburst	Disabled
Advanced Settings	
Enable Advanced Settings	Disabled

Table 7-I Default Settings - Process Setup

Changing Default Settings

From the Main Menu, go to Process Setup. Each of the items shown in the table above is listed as a Process Setup submenu item and can be customized for your process. Refer to ***Section 5, Operation, Pages 48-59*** for more information about working with the Process Setup menu.

Charts:Trigger Force, Weld Time, Weld Force

The charts that follow can help find starting values for Trigger Force, Weld Time, and Weld Force.

Using the Charts:

1. Measure the approximate length of the linear weld joint.
2. Find the corresponding number on the horizontal axis of each graph.
3. Follow that number up into the shaded portion of the chart for the appropriate value.

EXAMPLE: A part with a linear joint of 8 inches would have the following ranges:

Trigger Setting = 2.6-3.2 (40-55 pounds)

Weld Time = 0.40 - 0.65 seconds

Weld Force = 150-240 pounds

Initial Trigger Force

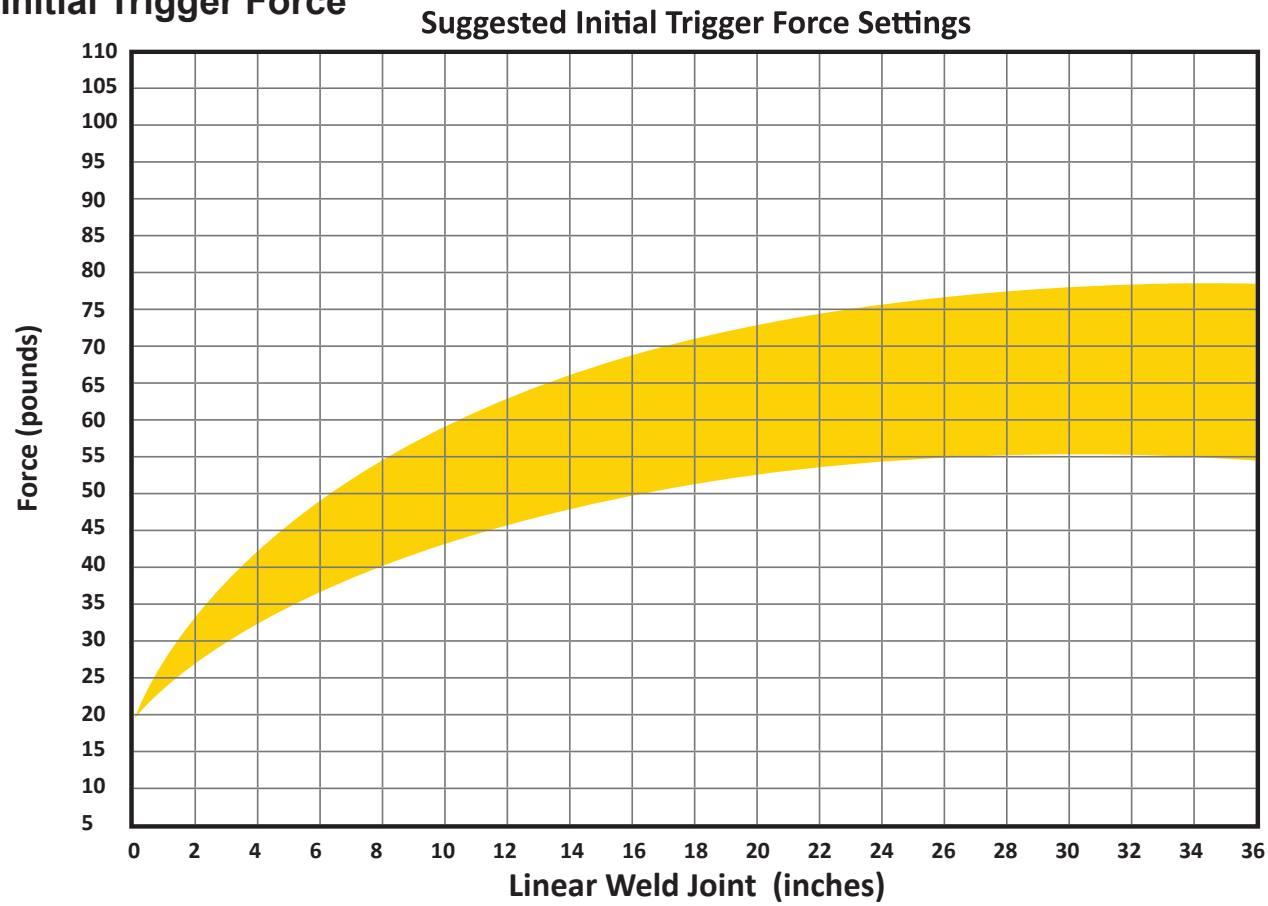

Figure 7-1 Suggested Initial Trigger Force

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Initial Weld Time

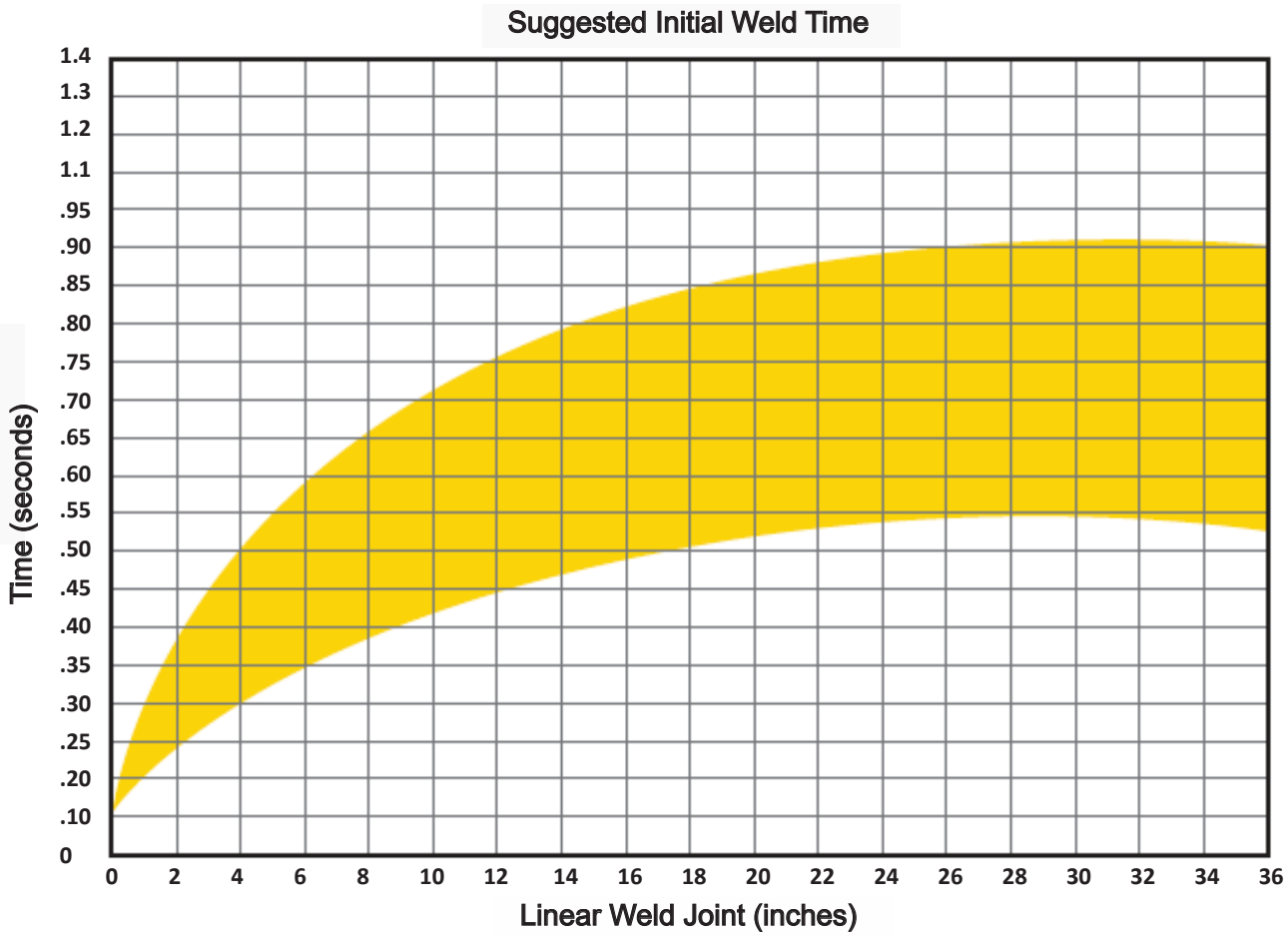

Figure 7-2 Suggested Initial Weld Time

Continued

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Initial Weld Force

NOTE

Downstroke pressure must be programmed so that enough force will be available to achieve the programmed Trigger Force. If there is not enough downstroke pressure, it may cause the system to fault at Max Trigger Time.

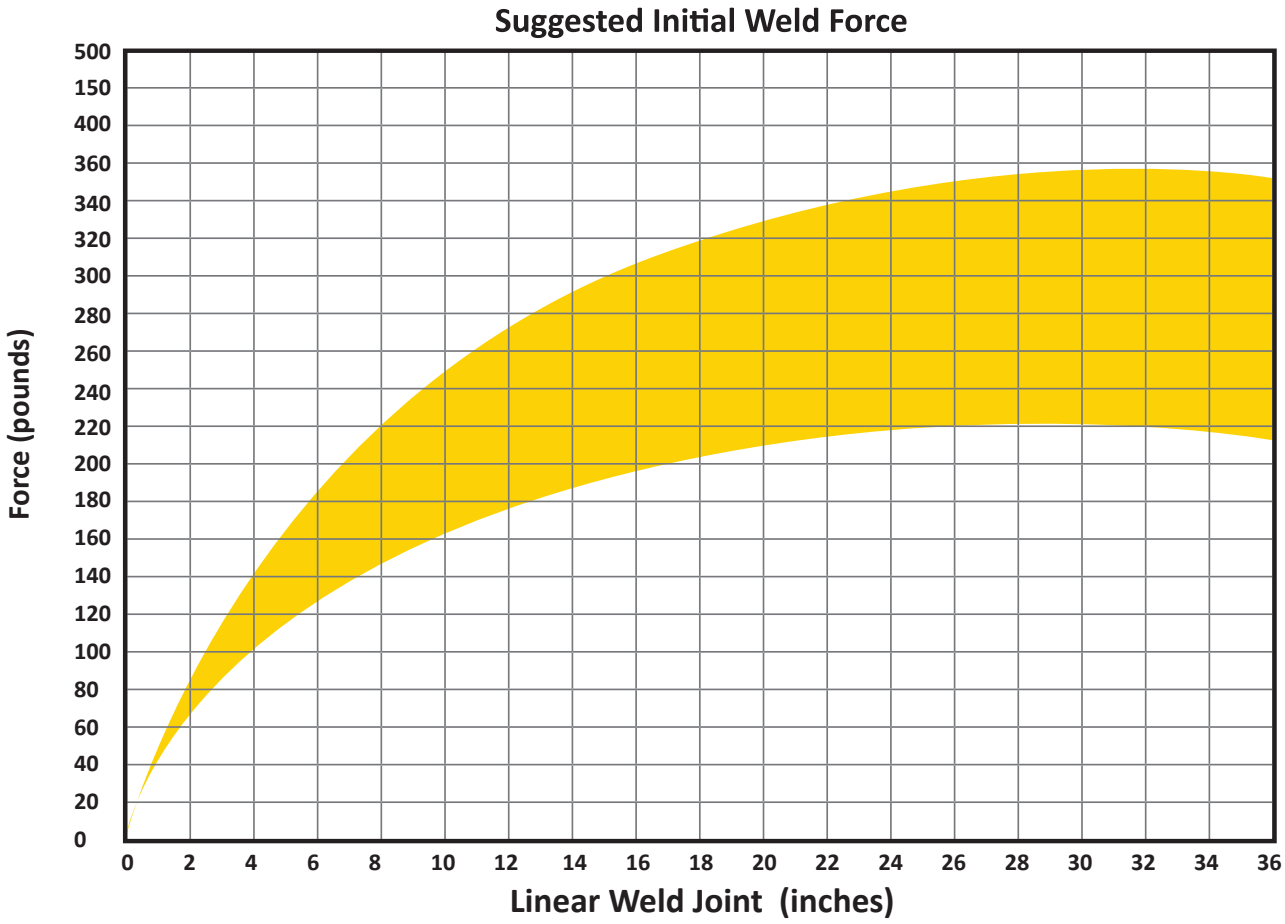

Figure 7-3 Suggested Initial Weld Force

Air Cylinder Size and Force

Verify the size of your air cylinder diameter.

Use Table 7-II below to determine actual force at a given pressure.

Pressure (psi)	Cylinder Diameter (in)			
	1.5	2.0	2.5	3.0
0	0	0	0	0
5	9	16	25	35
10	18	39	49	71
15	27	47	74	106
20	35	63	98	141
25	44	79	123	177
30	53	94	147	212
35	62	110	172	247
40	71	126	196	283
45	80	141	221	318
50	89	157	246	354
55	97	173	270	389
60	106	188	295	424
65	115	204	319	460
70	124	220	344	495
75	133	236	368	530
80	142	251	393	566
85	150	267	417	601
90	159	283	442	636
95	168	298	466	672
100	177	314	491	707
105	186	330	516	742
110	195	345	540	778

Table 7-II Pounds of Force Comparison between Dukane Air Cylinders

Troubleshooting

The iQ Generator Won't Cycle

Just before a weld cycle starts, the ***iQ*** generator waits for an initiating signal. If an initiating signal is applied and the system does not begin to cycle, check the following:

- Make sure the ***iQ*** generator's Initiate Mode in the Process Control menu is set to the appropriate setting:

  Manual if using operate switches; Auto if the system is configured for use with an automated system.

- Remove all inhibiting inputs and check that no Cycle Start error messages are displayed.
- Ensure that cabling is connected properly and that user interface circuitry is operating.

NOTE

The Initiate Mode selection must be set for each setup used. This is extremely important in the case of Sequencing and setup selection.

No Ultrasound

- To verify that the generator is producing an ultrasonic signal, use the acoustic stack test procedure described in ***Section 6, System Operational Testing***.
- Verify on the front panel that the generator is in the ONLINE mode.
- Verify pressure settings.
- Review the program. There should be a Weld Time P1 (and Weld Time P2 if dual pressure is used). Set the weld characteristic to Display using the generator's front panel Process Limits screen.
- From the Main Menu screen, select the Operate Screen key. Start the weld cycle, and view the reported weld time shown on the display. This tells that the controller has directed the generator to produce the ultrasonic signal for the programmed time.
- Verify that a time for the weld cycle is displayed.
- Verify that a value shows in Weld Peak Power, Method 1.

NOTE

If no value displays, there is a problem. For help, go to ***Section 10 - Contacting Dukane***, Page 123.

The Power-up Sequence Stops

Under normal conditions, power up starts when the generator REAR panel AC breaker switch is pushed to the ON position. Then the FRONT panel power indicator will flash for a few seconds, and finally turn a steady GREEN. This indicates that the system is operational.

If the power indicator stops flashing and remains RED, do not go any further, there is a problem with an internal power supply.

Operation of the front panel lighted power indicator:

• Steady Green - Generator is ready to cycle.

• Steady Red - There is a problem with an internal power supply.

NOTE

If troubleshooting does not provide satisfactory results, please contact Dukane Corporation (see ***Section 10 - Contacting Dukane***) for servicing. The ***iQ*** ES generator is serviceable only by Dukane personnel. Unauthorized attempts to service this product will void any warranty.

Alarm Messages

The following table lists alarms that may appear for the pneumatic systems containing a generator with a color front panel display (Q-Series) or ***iQ Explorer II*** software.

Information on particular alarms may also be obtained on the Dukane '"Easy Alarm" web page: ***http://www.dukane.com/us/DL_EasyAlarm.asp***

Continued

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Alarm Code	Alarm Message	Explanation	Solution
U100	Configuration Fault	Default Setup corrupted, Model Number incorrect, Serial Number incorrect, Feedback Scaling incorrect, etc.	This is a disabling condition for the generator; contact Dukane.
U101	Bad Parameter Alarm	Internal generator fault.	Contact Dukane.
U102	Watchdog Reset Alarm	Internal generator fault.	Contact Dukane.
U103	Hardware Fault	Hardware configuration or options were changed since last generator power up.	This is a disabling condition for the generator; contact Dukane.
U104	Frequency Overload Fault 1 (PLL Lock Fail)	The generator did not obtain a frequency lock by the end of ramp up period.	Press Test button on the power supply. Verify that the ultrasonic stack will operate in a test condition. Verify that the stack is operating at proper Frequency and Power draw. Reduce trigger pressure, force, and/or down speed. If stack will not operate in test perform stack care and maintenance. Follow this link to stack care and maintenance procedure. If Stack will not operate in test condition, remove horn and re-inspect. Enable "Advanced Process Settings" to adjust free run frequency to the "in air" operating frequency that results from a test. Enabling a pre-trigger source that allows for full ramp-up time to elapse still "in air" before contacting the part should eliminate all "Frequency Overload Fault 1" occurrences for a properly maintained stack. If the above steps do not resolve problem, contact Dukane.
U105	Frequency Overload Fault 2 (PLL Lock Lost)	The stack may be coupling the part to the fixture.	Attempt to decouple vibrations from fixture by using a compliant medium, such as a sheet of silicone or cork, between the part and fixture, or fixture and base.
U106	POS Peak Overload Fault	Generator ultrasound overload.	Check if one of the stack components is defective. Check if one of the stack components is loose. Check if the iQ generator's system frequency settings are set correctly.
U107	NEG Peak Overload Fault	Generator ultrasound overload.	Check if one of the stack components is defective. Check if one of the stack components is loose. Check if the iQ generator's system frequency settings are set correctly.
U108	Average Overload Fault	Generator ultrasound overload.	Reduce the force being applied to the part (on a pneumatic press) or reduce the weld speed (on a servo press).
U109	Bad Current Loop Fault	4-20 mA current loop is not connected to the remote amplitude card, or 4-20 mA current loop is defective (poor electrical).	Check for proper connection to remote amplitude card. Check for damage to wiring. This is a disabling condition for the generator; contact Dukane.

Table 7-III Alarm Message Screens - Page 1 of 3

Continued

Continued from Previous Page

Alarm Code	Alarm Message	Explanation	Solution
U110	Power not OK Fault	Problem with incoming AC line voltage.	Verify that the incoming AC Line voltage supplied to the generator is within the range specified for the generator. Consult the manual for your generator
U111	Overtemperature Fault	Generator has exceeded its temperature limit.	Check for blockage of air vents on the sides of the generator, restricting air flow to the inside of the generator. Check if the internal fan is defective.
U112	Frequency Overload Fault 3 (PLL Limit Exceeded)	The operating frequency was artificially bounded by the system frequency limits for 25 consecutive milliseconds. This is usually due to excessive operating frequency drift (operating frequency is "far" from free run frequency) due to heating of the stack.	Execute the following steps to alleviate the problem: Observe the last operating frequency from a test graph. Enable "Advanced Process Settings". Change "System Frequency Limits" to "Manual" and adjust the offending upper/lower frequency limit to an acceptably safe value for your horn/stack/application. Often as a horn/stack heats up, it may begin to have trouble starting (Frequency Overload Fault 1) because the operating frequency is drifting away from the generator's Free Run Frequency setting. Adjusting the Free Run Frequency may also be advisable. A sudden shift in frequency (as observed on the graph) immediately before a Frequency Overload Fault 3, as opposed to a general frequency drift, indicates stack/horn coupling to the part during the weld or an another abrupt change in stack resonance. This does not imply an operating frequency drift issue, but a weld application setup issue.

Table 7-III Alarm Message Screens - Page 2 of 3

Continued

Continued from Previous Page

Alarm Code	Alarm Message	Explanation	Solution
U300	Operate Switch 1 Pressed before Cycle Start		Release Switch 1 before pressing both activation switches to start a cycle. Verify wiring of both switches.
U301	Operate Switch 2 Pressed before Cycle Start		Release Switch 2 before pressing both activation switches to start a cycle. Verify wiring of both operating switches.
U302	Auto In Switch closed at End of Cycle		Remove active Auto-In signal. Verify wiring to Auto-In signal.
U308	Generator or Press Not Ready	iQ generator initialization process is not complete.	Wait for initialization process to complete. Cycle power on iQ generator. If alarm persists, contact Dukane.
U400	Weld Limits enabled for continuous operation		Change Weld Mode from Automation. Disable Weld Method.
U401	Weld Time set to Zero		Adjust weld time to be greater than zero.
U402	Weld Power set to Zero		Adjust weld peak power to be greater than zero.
U403	Weld Energy set to Zero		Adjust weld energy to be greater than zero.
U404	Weld Distance set to Zero		Adjust weld distance to be greater than zero.
U405	Weld Position set to Zero		Adjust weld position to be greater than zero.
U406	Max Trigger Time set to Zero		Adjust maximum trigger time to be greater than zero.
U407	Forced Shutdown Alarm	External command was received by generator to end weld cycle.	This alarm is for information only.
U411	Part Detected Too Early	Contact between the horn and part was detected before reaching the Sensing Start Position.	Adjust Sensing Start Position to be above contact with part. Account for variation of heights of unassembled parts. NOTE: Repeated occurrences of this alarm may result in costly damage to servo actuator.
U413	Max Trigger Time Exceeded	Trigger did not occur within the specified time limit.	Increase maximum trigger time. Start the weld process sooner.
U414	Max Trigger Delay Time Exceeded	Trigger delay distance was not reached within the specified time limit.	Increase maximum trigger delay time. Start the weld process sooner.
U501	End of Weld Signal Detected	When Auto-stop is enabled and set for End of Weld, this alarm indicates that the signal has been detected.	This alarm is for information only.
U502	End of Cycle Signal Detected	When Auto-stop is enabled and set for End of Cycle, this alarm indicates that the signal has been detected.	This alarm is for information only.

Table 7-III Alarm Message Screens - Page 3 of 3

Continued

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SECTION 8

Maintenance

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Front and Rear Panels

Cleaning

- Do not use any solvents or abrasive cleaners to clean any of the panels.
- Do not spray or apply cleaner directly on the generator.
- Apply a small amount of cleaner on a soft, clean cloth first. Then, clean the panel with the moistened cloth.

Power Button

The button responds well to firm, gentle finger pressure. Do not use sharply pointed tools or other objects that could damage the button.

Chassis

Sheet Metal Cover

The cover is preformed to fit over the chassis and has protective grills over the cooling air vents. Keep the cover on at all times because there are high voltages present which could cause injury. The internal case also contains capacitors which continue to hold a high electrical charge, even after the power is shut off.

Air Ventilation Slots

Keep the ventilation slots free from obstructions. If excessive dust or dirt collects on the slots, wipe or vacuum them clean. Do not use compressed air to clean them as this may force the dirt inside the chassis.

Allow 5 inches (127 mm) of clearance outside each ventilation slot.

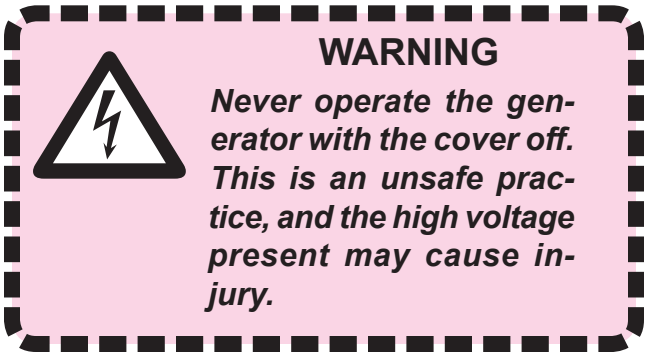
The air intake is on the right, and the exhaust is on the left. This is shown in Figure 3–3, Page 15.

I/O Connector

The Input/Output connector has a pair of 4-40 threaded jack screws to secure the connector. Make sure the screws are snug, but **do not overtighten them.**

AC Power Cord

The AC power cord should be kept in good condition and free from any cuts. The AC plug should be straight with no bent prongs.


WARNING
Never operate the generator with the cover off. This is an unsafe practice, and the high voltage present may cause injury.

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SECTION 9

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RS-232 Port J10 120
Press Interface Module. 122
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P6 EPR/Load Cell with Distance 122

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Power Inlet Options

120V Systems for North America and Japan

120V systems for North America and Japan have a fixed (non-detachable) power cord.

This option is available on generators with power ratings up to 1200 Watts.

240V Systems

Generators with power ratings above 2400 Watts also have fixed power cords.

See Table 11-II in ***Section 11, Specifications***.

NOTE

Refer to ***Section 2 - Health and Safety***, Pages 8 and 9 for information about Electrical Safety including grounding.

Data Transfer

Board and port locations are shown in Figure 3-4.

Ethernet Port, J9

J9 is the generator's Ethernet port. A cable connects J9 to the HMI Ethernet port.

RS-232 Port, J10

Cycle data can be sent from this serial RS-232 port. Typically the data is sent to a PC where it can be stored or manipulated to suit the user.

Probe - When using a probe with the generator, cycle data can be sent at predetermined intervals.

Press - When using a press with the generator, cycle data is sent following each cycle.

Output Format - The Comma Separated Value (CSV) format is used. With this format, each characteristic value is output along with an additional part data index unique to a particular characteristic.

This allows a program to identify each characteristic and store it in an appropriate file regardless of the order in which the characteristic is received.

Figure 9-1 shows an example of this output format, and Table 9-I on the next page gives the Part Data Index numbers and descriptions.

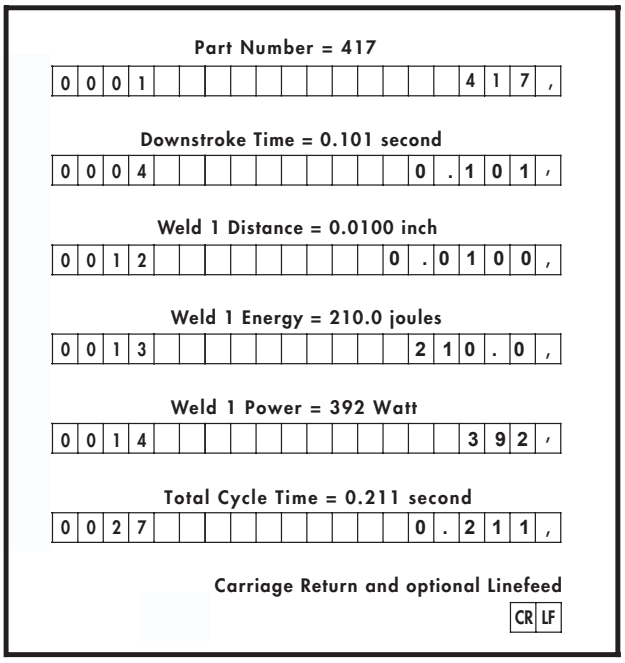
Part Number = 417
0 0 0 1 4 1 7 ,
Downstroke Time = 0.101 second
0 0 0 4 0 . 1 0 1 ,
Weld 1 Distance = 0.0100 inch
0 0 1 2 0 . 0 1 0 0 ,
Weld 1 Energy = 210.0 joules
0 0 1 3 2 1 0 . 0 ,
Weld 1 Power = 392 Watt
0 0 1 4 3 9 2 ,
Total Cycle Time = 0.211 second
0 0 2 7 0 . 2 1 1 ,
Carriage Return and optional Linefeed
CR LF

Figure 9-1 CSV Output Format

Part Data Indexes	
Number	**Description**
1	Part Number
2	Sequence Index
3	Sequence Count
4	Downstroke Time
5	Downstroke Distance
6	Average Down Velocity
7	Trigger Pressure
8	Trigger Delay Time
9	Trigger Delay Dist
10	Force At Trigger
11	Weld 1 Time
12	Weld 1 Distance
13	Weld 1 Energy
14	Weld 1 Power
15	Weld 1 Position
16	Weld Peak Force
17	Weld 2 Time
18	Weld 2 Distance
19	Weld 2 Energy
20	Weld 2 Power
21	Weld 2 Position
22	Total Weld Time
23	Total Weld Distance
24	Total Weld Energy
25	Hold Time
26	Hold Distance
27	Total Cycle Time
28	Total Stroke
50	Time Format: HH:MM:SS
51	Date -> Formats: DD/MM/YYYY, MM/DD/YYYY, YYYY/MM/DD
52	Setup Number
53	Error Code -> "U Number" without the 'U'

Table 9-I Part Data Indexes

NOTE

Individual data records are separated by a comma, tab, or semicolon. The character used is set in the Hardware Settings screen. See Page 72 for setting the Output Format character.

The indexes are printed as 4 characters '0' padded, and the entire field size is 20 characters including the delimiter. The data is right justified with spaces.

Complete cycle data record is terminated by carriage return and optional line feed characters.

The format is meant to mimic Dukane's DPC generator protocol as closely as possible.

Press Interface Module

This board is also known as the Options Slot #1 as shown in Figure 11-4, Interpreting the Model Number. Module location is shown in Figure 3-4.

Each option is described in general terms:

P4 - Dual Pressure Only P/N 110-4426

Dual pressure is a feature that is exclusive to Dukane press systems. It increases clamp force to improve the plastic melt and flow during the weld portion of a cycle and assures tight assembly during the hold portion by welding parts at one pressure and holding them together at a second pressure. Dual pressure can also be used to begin a weld at one pressure, finish the weld at a second pressure, then hold the assembly together at the second pressure.

P5 - Dual Pressure with Distance P/N 110-4427

Dual pressure is a feature that is exclusive to Dukane press systems. See the **P4** description above.

Weld by distance mode controls the melt collapse distance to ensure that the same volume of material melts on each part. The result: finished joint strength is consistent.

All distance parameters - downstroke, trigger delay, weld, hold, absolute weld, total weld, and total stroke distance - are monitored to show upper and lower limits for bad and suspect parts. This will verify part quality and uniformity.

Dukane's linear optical encoder has a one-micron resolution to insure exceptional precision and repeatability.

P6 - EPR/Load Cell with Distance P/N 110-4428

This option offers programmable pressure profiling and force by interfacing with the EPR (electronic pressure regulator), pressure transducer, and load cell. Increased control, repeatability and consistency are benefits.

The electronic pressure regulator and pressure transducer are components of the same system. The electronic pressure regulator accepts commands from the generator and sets the air pressure to the user-selected value. The pressure transducer senses the pressure and transmits it to the generator via a 4-20 mA current loop.

The force transducer (load cell) senses force exerted on the part and controls when the ultrasound signal is applied.

See **P5** for more information on distance.

SECTION 10

Contacting Dukane

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Contacting Dukane

Identify Equipment

When contacting Dukane about a service–related problem, be prepared to give the following information:

- Model number and serial number.
- Alarm indicators from the generator or displayed by ***iQ Explorer II***.
- Software version.
- Problem description and steps taken to resolve it.

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Intelligent Assembly Solutions

Mailing Address: Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174 US

Phone: (630) 797–4900

E-mail: **ussales@dukane.com**

Fax:
Main (630) 797–4949

Service & Parts (630) 584–0796

Website

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature.

Here is the address for the main website:

www.dukane.com/us/

You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm

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SECTION 11

Specifications

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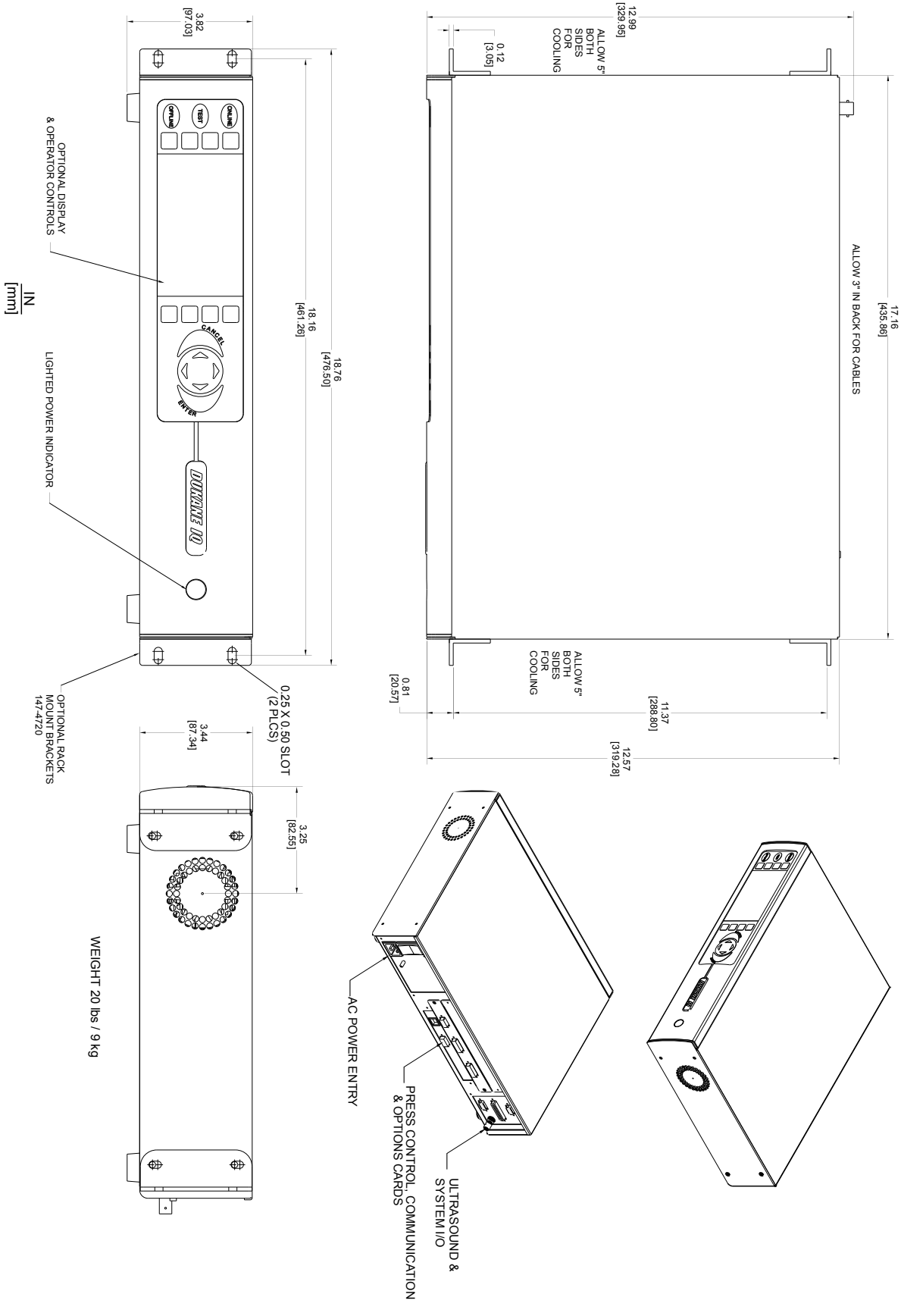


Figure 11-1 Layout - Low Profile *iQ* Generator

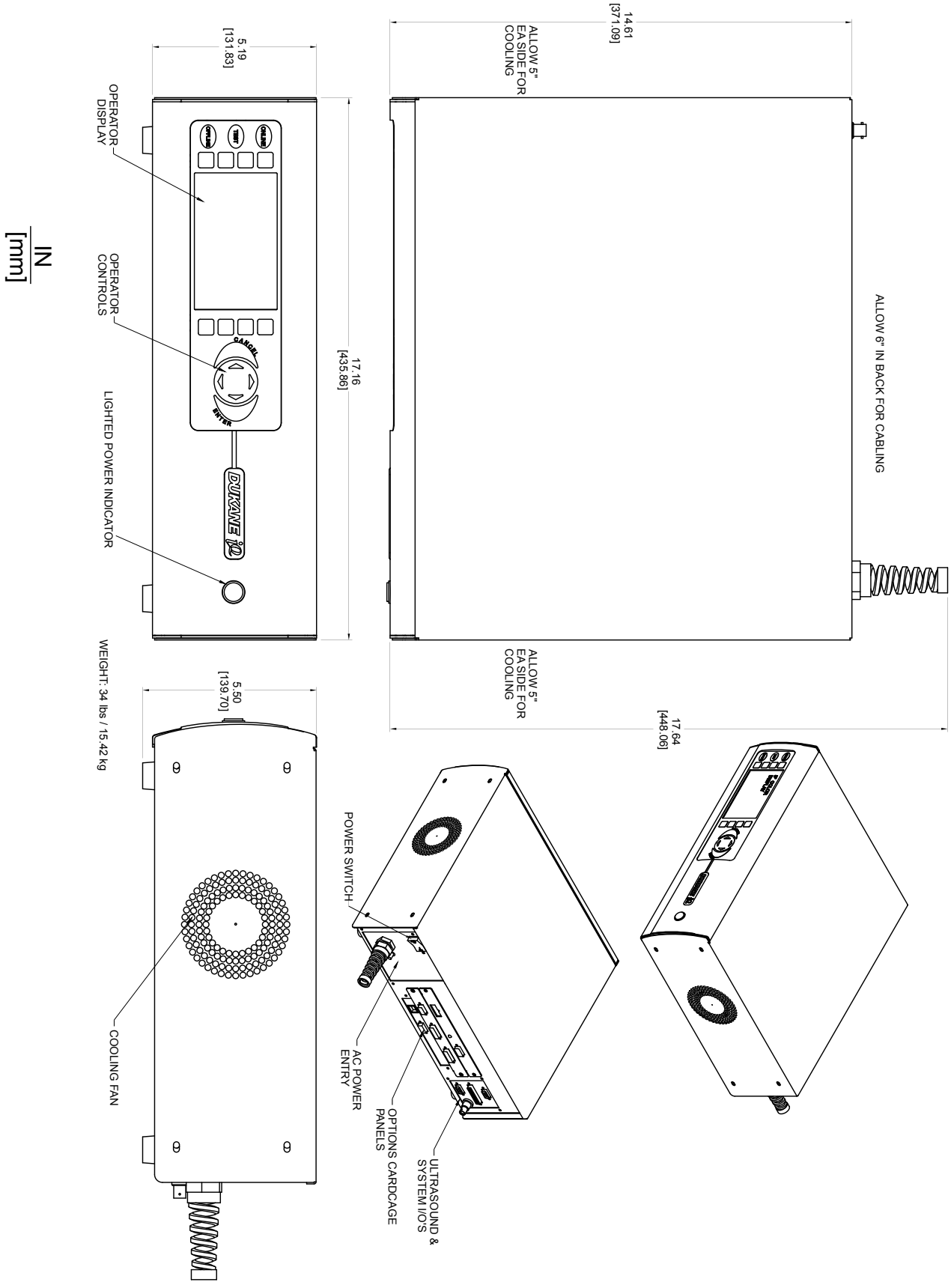


Figure 11-2 Layout - High Power *iQ* Generator

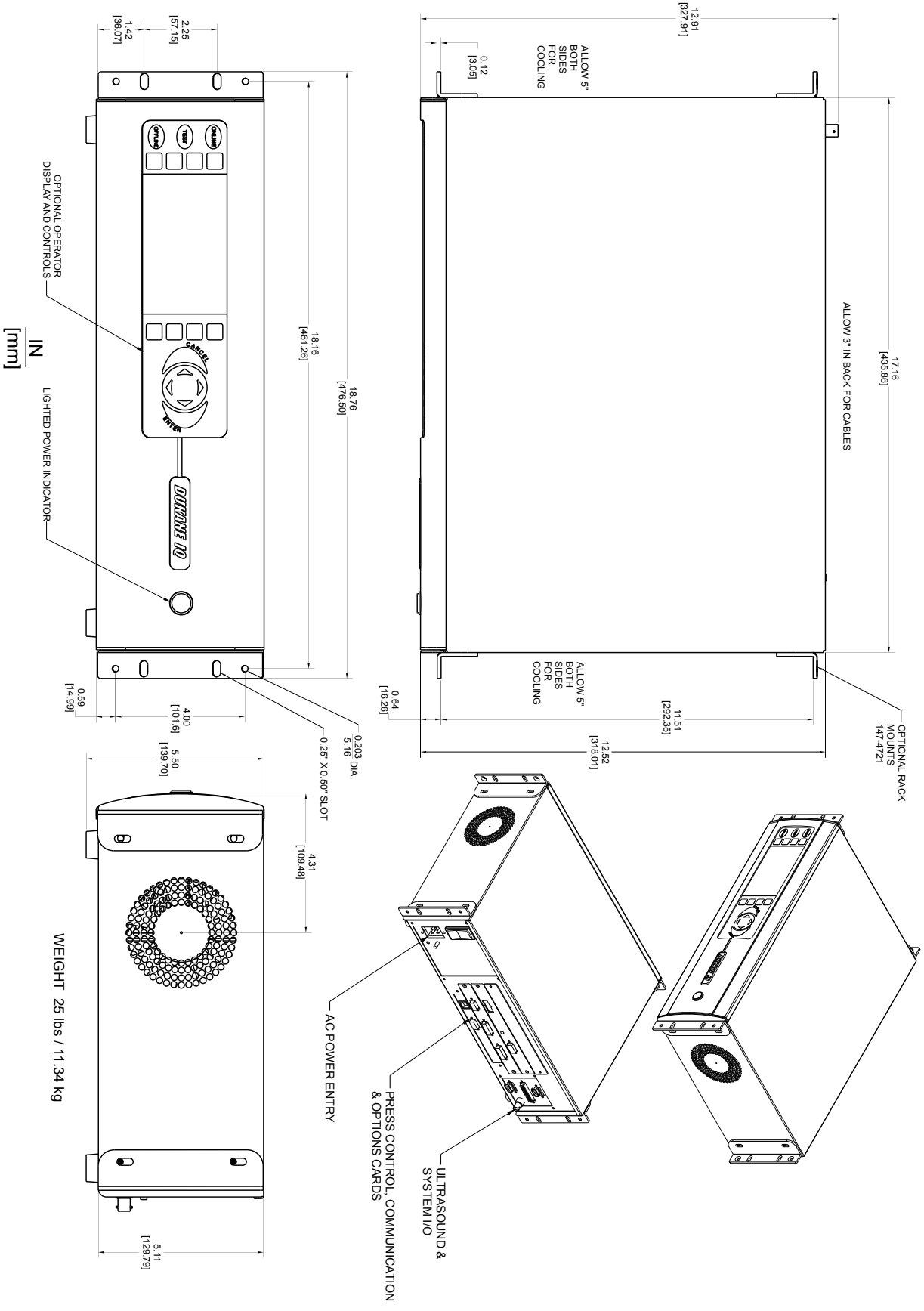


Figure 11-3 Layout - High Profile ***iQ*** Generator

Weights

	High Profile		Low Profile		High Power	
	lb	kg	lb	kg	lb	kg
Generator Only	25	11.3	20	9.1	34	15.4
Generator + Packing Materials	30	13.6	25	11.3	39	17.7

Table 11–I *iQ* Generator Weights

Dimensions

Dimensions - in (mm)

Model	Height **	Width	Depth
Low Profile	3.45 (87.6)	17.16 (435.9)	12.55 (318.8)
High Profile	5.19 (131.8)	17.16 (435.9)	12.55 (318.8)
High Power	5.19 (131.8)	17.16 (435.9)	14.51 (368.6)

Table 11–II *iQ* Generator Dimensions

NOTE

** Add approximately 0.4" (10 mm) to height when the generator is equipped with factory installed feet.
Add between 3" and 6" (76 - 152 mm) behind the generator and 5" (127 mm) for air flow and cable connections.

Operating Environment

Operate the equipment within these guidelines:

Temperature: 40°F to 100°F (+5°C to +38°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% Non–condensing @ +5°C to +30°C

Storage guidelines for deactivated equipment:

Temperature: -4°F to 158°F (-20°C to +70°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% Non–condensing @ 0°C to +30°C

AC Power Requirements

Generator

The AC line voltage and current needed depend on whichever generator has been chosen for your system. See the table below.

Operating Frequency	Generator Model Number	Overload Power Ratings (Watts)	Input AC Power Requirements Nominal AC Volt @ Maximum RMS Current	North America/ Japan AC Outlet Rating	Output Voltage (Max)	Output Current (Max)
15kHz	15HS360-2Q-XX-XX	3600	200-240V 50/60 Hz @ 25 Amps	30 Amps	1400 VAC (Nominal)	5 A (Nominal)
15kHz	15HS480-2Q-XX-XX	4800	200-240V 50/60 Hz @ 30 Amps			
20kHz	20HS060-1Q-XX-XX	600	100-120V 50/60 Hz @ 8 Amps			
20kHz	20HS060-2Q-XX-XX	600	200-240V 50/60 Hz @ 5 Amps			
20kHz	20HS090-1Q-XX-XX	900	**100-120V 50/60 Hz @ 15 Amps	15 Amps	700 - 1300 VAC (Nominal)	1.5 - 3 A (Nominal)
20kHz	20HS090-2Q-XX-XX	900	200-240V 50/60 Hz @ 8 Amps			
20kHz	20HS120-1Q-XX-XX	1200	**100-120V 50/60 Hz @ 15 Amps			
20kHz	20HS120-2Q-XX-XX	1200	200-240V 50/60 Hz @ 8 Amps			
20kHz	20HS180-2Q-XX-XX	1800	200-240V 50/60 Hz @ 12 Amps			
20kHz	20HS240-2Q-XX-XX	2400	200-240V 50/60 Hz @ 15 Amps			
20kHz	20HS360-2Q-XX-XX	3600	200-240V 50/60 Hz @ 25 Amps	30 Amps	1400 VAC (Nominal)	5 A (Nominal)
20kHz	20HS480-2Q-XX-XX	4800	200-240V 50/60 Hz @ 30 Amps			
30kHz	30HS090-1Q-XX-XX	900	100-120V 50/60 Hz @ 8 Amps	15 Amps	700 - 1300 VAC (Nominal)	1.5 - 3 A (Nominal)
30kHz	30HS090-2Q-XX-XX	900	200-240V 50/60 Hz @ 8 Amps			
30kHz	30HS120-1Q-XX-XX	1200	**100-120V 50/60 Hz @ 15 Amps			
30kHz	30HS120-2Q-XX-XX	1200	200-240V 50/60 Hz @ 8 Amps			
30kHz	30HS180-2Q-XX-XX	1800	200-240V 50/60 Hz @ 12 Amps			
40kHz	40HS060-1Q-XX-XX	600	100-120V 50/60 Hz @ 8 Amps			
40kHz	40HS060-2Q-XX-XX	600	200-240V 50/60 Hz @ 5 Amps			
40kHz	40HS090-1Q-XX-XX	900	100-120V 50/60 Hz @ 15 Amps			
40kHz	40HS090-2Q-XX-XX	900	200-240V 50/60 Hz @ 8 Amps			
40kHz	40HS120-1Q-XX-XX	1200	**100-120V 50/60 Hz @ 15 Amps			
40kHz	40HS120-2Q-XX-XX	1200	200-240V 50/60 Hz @ 8 Amps			

Table 11-III Generator AC Power Requirements

NOTES:

An X used above in the Model Numbers is a “wildcard” character meaning any valid character code combination.

Maximum line current requirement is specified at the minimum nominal AC line voltage and the rated power level.

**If the input line voltage is less than 100V, the output current will exceed 15 Amps.

Ultrasonic Pressure

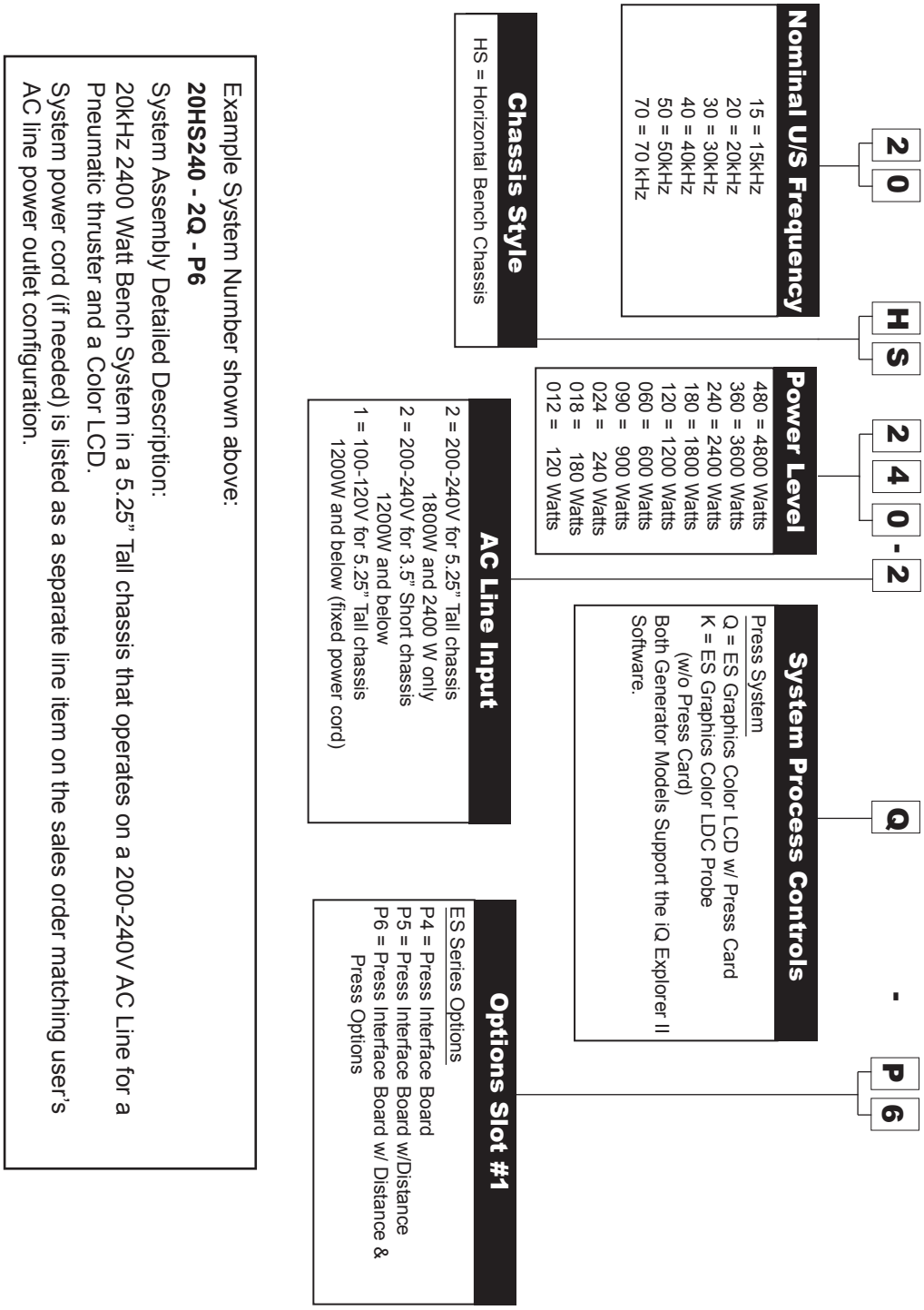
Ultrasonic Pressure					
***iQ* Generator Models - kHz**	15	20	30	40	50
Useful Beam	360 degrees				
Ultrasonic Pressure @ Operator's Position - dB	125	140	130	130	130
Ultrasonic Pressure 1 m from the Equipment- dB	110	130	110	105	110

Table 11–IV *iQ* Generator Ultrasonic Pressure

NOTE

All measurements taken with Data Physics Dynamic 4-Channel Signal Analyzer with calibrated 377C01 Microphone and 426B02 Preamplifier.

Interpreting the Model Number


iQ Generator Model Number Codes
2 0
H S
2 4 0 - 2
Q
P 6
Nominal U/S Frequency
15 = 15kHz
20 = 20kHz
30 = 30kHz
40 = 40kHz
50 = 50kHz
70 = 70 kHz
Chassis Style
HS = Horizontal Bench Chassis
Power Level
480 = 4800 Watts
360 = 3600 Watts
240 = 2400 Watts
180 = 1800 Watts
120 = 1200 Watts
060 = 600 Watts
090 = 900 Watts
024 = 240 Watts
018 = 180 Watts
012 = 120 Watts
System Process Controls
Press System
Q = ES Graphics Color LCD w/ Press Card
K = ES Graphics Color LDC Probe
(w/o Press Card)
Both Generator Models Support the iQ Explorer II Software.
AC Line Input
2 = 200-240V for 5.25" Tall chassis
1800W and 2400 W only
2 = 200-240V for 3.5" Short chassis
1200W and below
1 = 100-120V for 5.25" Tall chassis
1200W and below (fixed power cord)
Options Slot #1
ES Series Options
P4 = Press Interface Board
P5 = Press Interface Board w/Distance
P6 = Press Interface Board w/ Distance & Press Options

Example System Number shown above:

20HS240 - 2Q - P6

System Assembly Detailed Description:

20kHz 2400 Watt Bench System in a 5.25" Tall chassis that operates on a 200-240V AC Line for a Pneumatic thruster and a Color LCD.

System power cord (if needed) is listed as a separate line item on the sales order matching user's AC line power outlet configuration.

Figure 11-4 Interpreting the Model Number

Regulatory Agency Compliance

FCC

The generator complies with the following Federal Communications Commission regulations.

- The limits for FCC measurement procedure MP-5, "Methods of Measurement of Radio Noise Emissions from ISM Equipment", pursuant to FCC Title 47 Part 18 for Ultrasonic Equipment.

CE Marking

This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Europeéne (European Conformity). The equipment complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —
  EN 61000-6-4: 2001
  EN 55011: 2003
  EN 61000-6-2: 2005
  EN61000–4–2
  EN61000–4–3
  EN61000–4–4
  EN61000–4–5
  EN61000–4–6
  EN61000–4–8
  EN61000–4–11
- The Low Voltage Directive 2006/95/EC.
- The Machinery Directive 2006/42/EC.
  EN 60204: 2006
  Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirements.

IP Rating

The ***iQ*** generator has an IP (International Protection) rating from the IEC (International Electrotechnical Commission).

The rating is IP2X, in compliance with finger-safe industry standards.

UL

The ***iQ*** generator complies with these standards:

Underwriters Laboratories:

UL 1012: 2010

UL 61010-1:2012, and

National Standards of Canada:

CAN/CSA C22.2 No. 61010-1-12:2012

as verified by TÜV Rheinland.

CAUTION

DO NOT make any modifications to the generator or associated cables as the changes may result in violating one or more regulations under which this equipment is manufactured.

SECTION 12

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Appendix C

Sequencing Notes

Sequencing is typically used for operations where parts must be staked or inserted and need more than one processing step or more than one set of process parameters.

To use the sequencing feature, the operations performed on a part must be grouped according to a setup number. Once the setup parameters have been established for each group, determine the order in which the groups are to be processed.

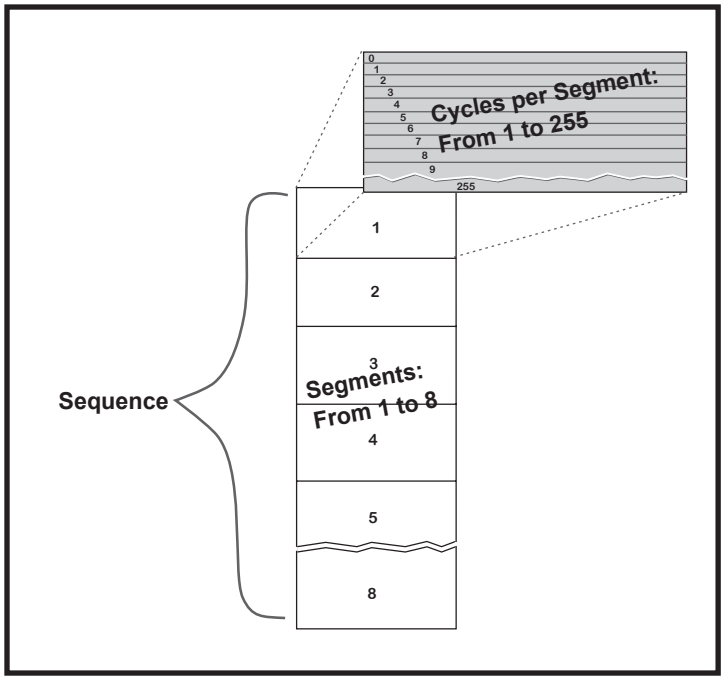
This order of operations determines the order of the segments in the sequence definition.

(See Sequence Definition, Page 146.)

The figure below gives a graphic representation of a sequence.

NOTE

See Page 67 - Process Utilities, Setup Control.



The figure shows that a sequence is a process having from 1 to 8 segments and each of those segments has from 1 to 255 cycles.

Figure C-1 What is a Sequence?

Continued

Appendix C Sequencing Notes

In this example, a sequence to be used in an insert application has two segments. The first part of the sequence is known as Setup 01 which will process four #1 inserts. The second part of the sequence is Setup 02 which will process four #2 inserts.

Segment 1 deals with insert #1, and Segment 2 deals with insert #2. Each segment has four cycles. When the cycles are finished, the sequence is reset to begin processing another part.

The figure below gives a graphic representation of what this sequence might look like on an X-Y table.

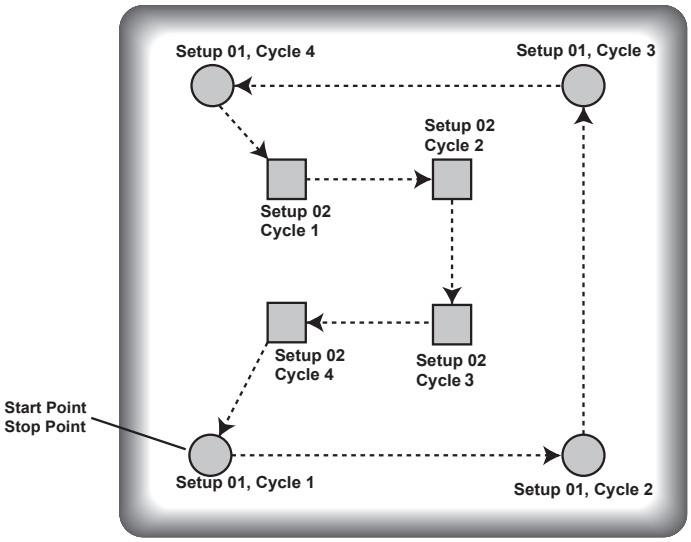


Figure C-2 Insertion Sequence Example

Continued

Appendix C Sequencing Notes

Sequence Definition

Figure C-3 illustrates that when defining a sequence, there are five parts of the definition to consider:

- Sequence Length - Choose 1-8 Segments
- Define Part as Cycle or Sequence
- Current Cycle - Choose 1-8
- Current Segment - Choose 1-8
- Process Cycles for a Given Segment - Choose 1-255

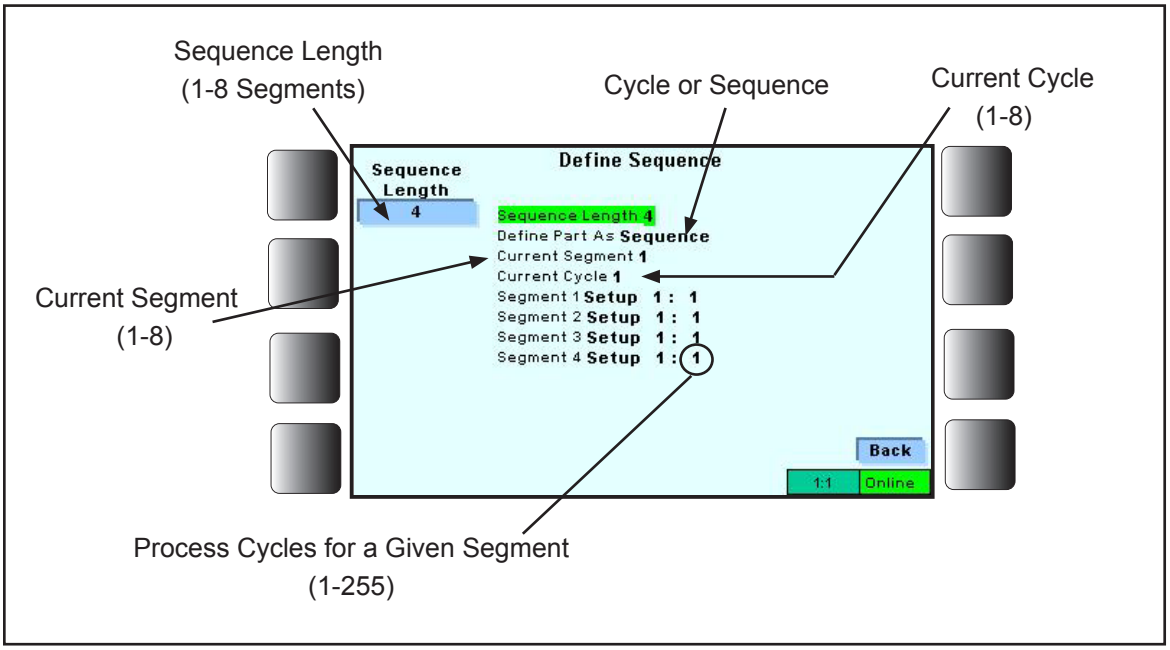
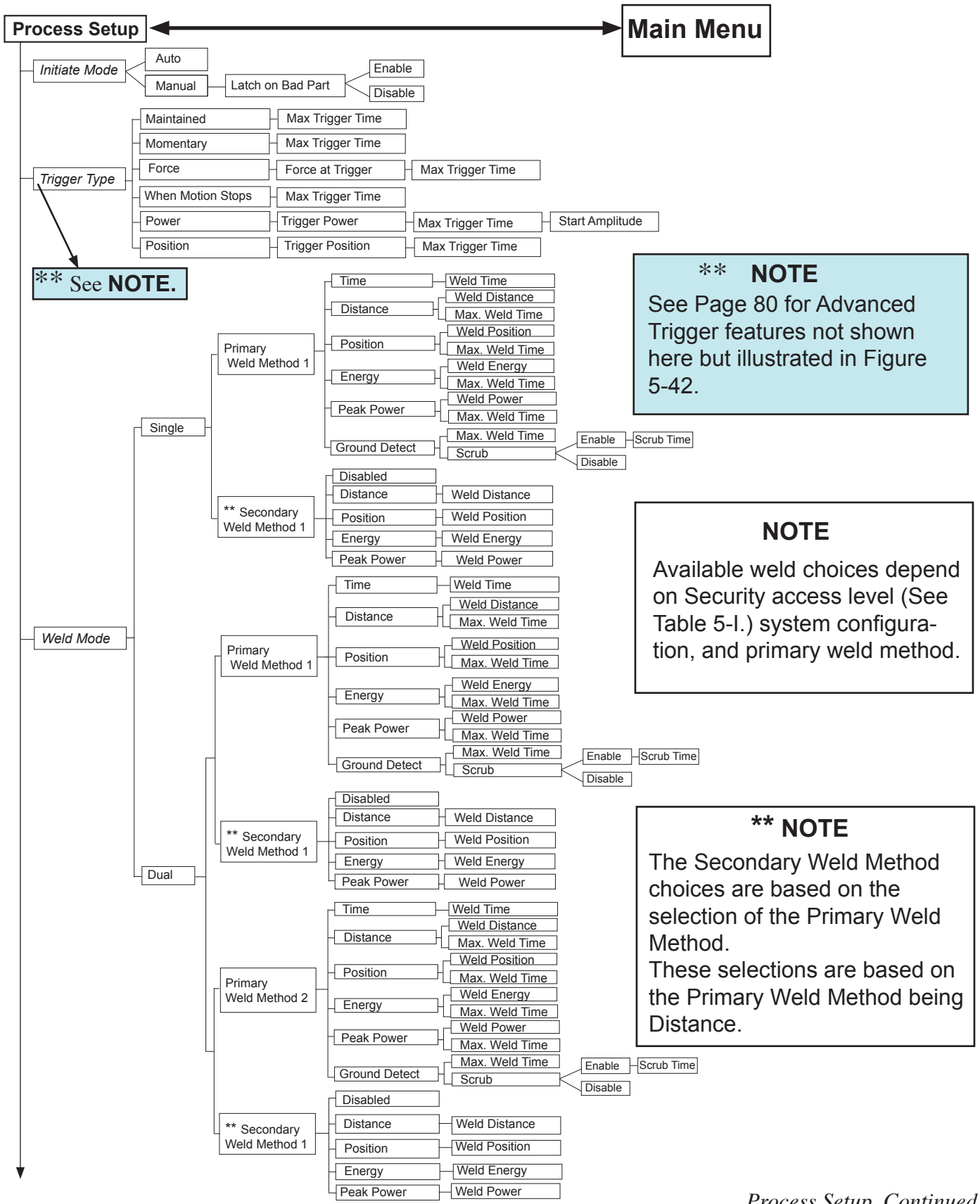


Figure C-3 Sequence Definition

Appendix D Menu Structure Diagrams



Process Setup, Continued

Figure D-1 Process Setup Menu Diagram (1 of 2)

Appendix D Menu Structure Diagrams

Process Setup, Continued from Previous Page

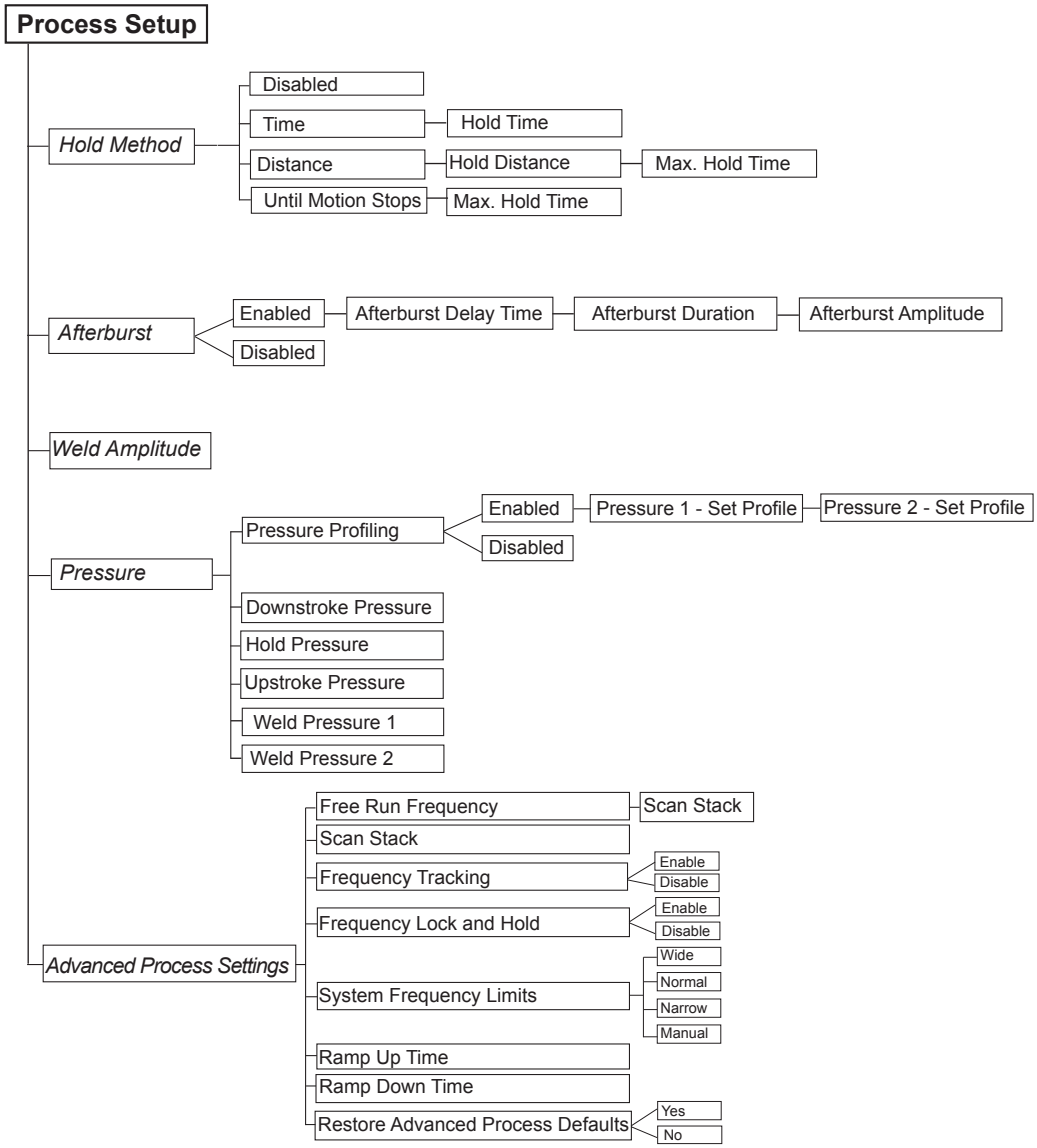
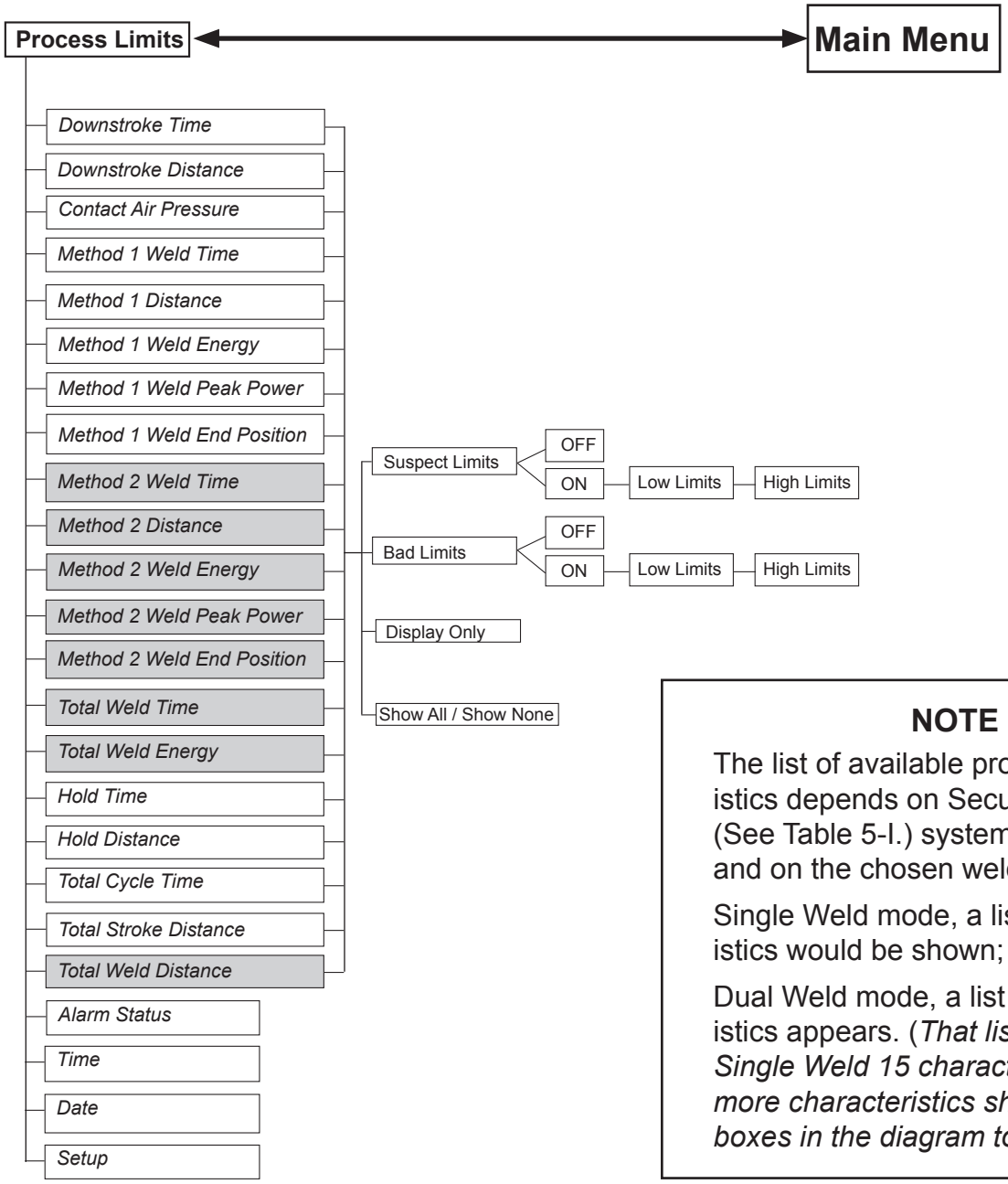


Figure D-1 Process Setup Menu Diagram (2 of 2)

Appendix D Menu Structure Diagrams



NOTE

The list of available process characteristics depends on Security access level (See Table 5-I.) system configuration, and on the chosen weld mode:

Single Weld mode, a list of 15 characteristics would be shown;

Dual Weld mode, a list of 23 characteristics appears. (*That list includes the Single Weld 15 characteristics, plus eight more characteristics shown in shaded boxes in the diagram to the left.*)

Figure D-2 Process Limits Menu Diagram

Appendix D Menu Structure Diagrams

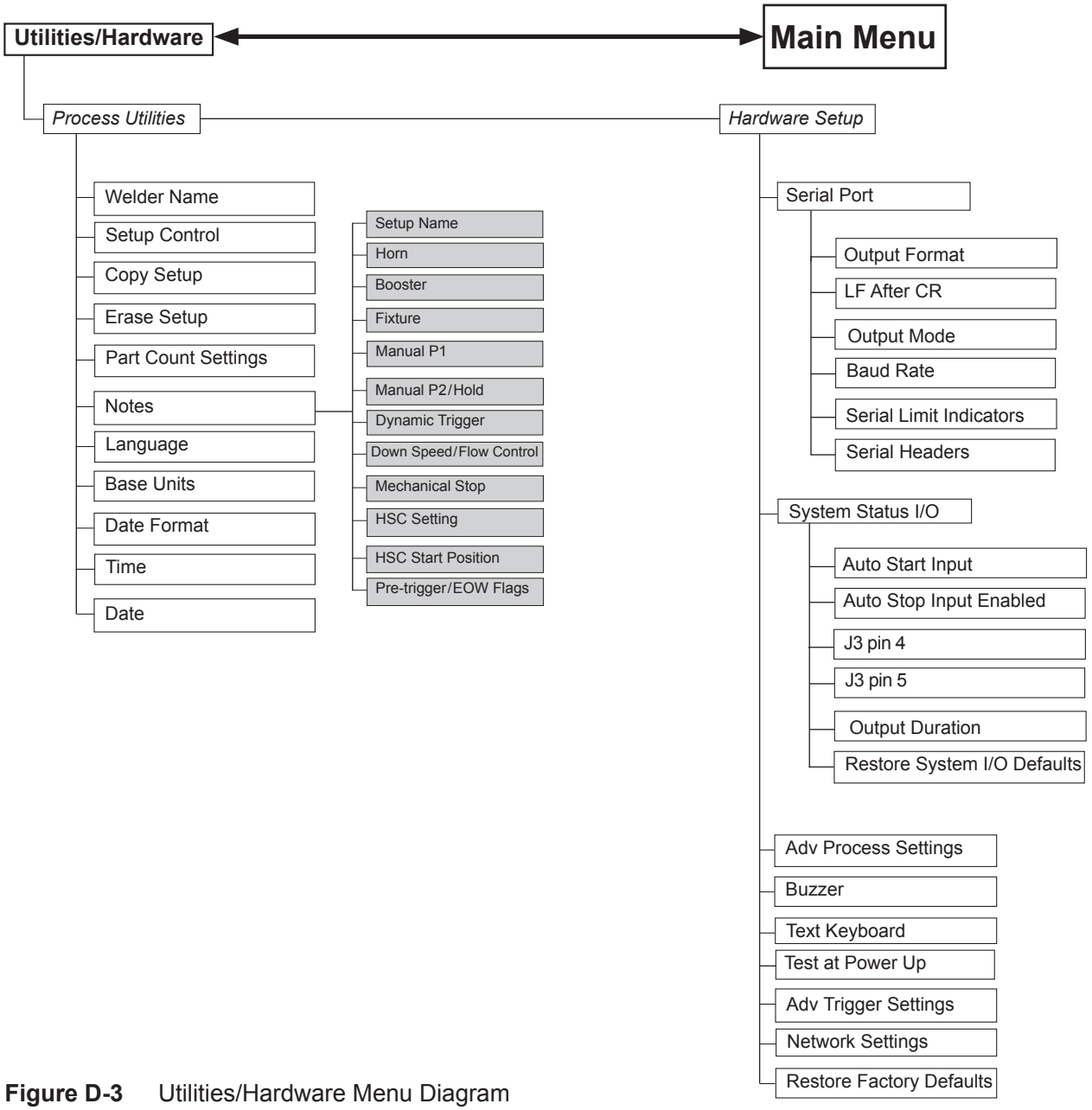


Figure D-3 Utilities/Hardware Menu Diagram

NOTE

The list of available Process Utilities and Hardware items depends on Security access level (See Table 5-I.) and on system configuration.

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Dukane ISO

ISO CERTIFICATION

Dukane chose to become ISO 9001 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well–defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure.

The ISO 9001 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection–oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

ISO 9001 CERTIFIED

Dukane products are manufactured in ISO registered facilities.

View the Dukane ISO certificate of compliance at: http://www.dukane.com/ISORegistrationCertificate.pdf

Please refer to our website at:

www.dukane.com/us/sales/intsales.htm

to locate your local representative.

iQ Series Ultrasonic Generator/Power Supply, Pneumatic Systems,
ES User's Manual
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